Electrical World

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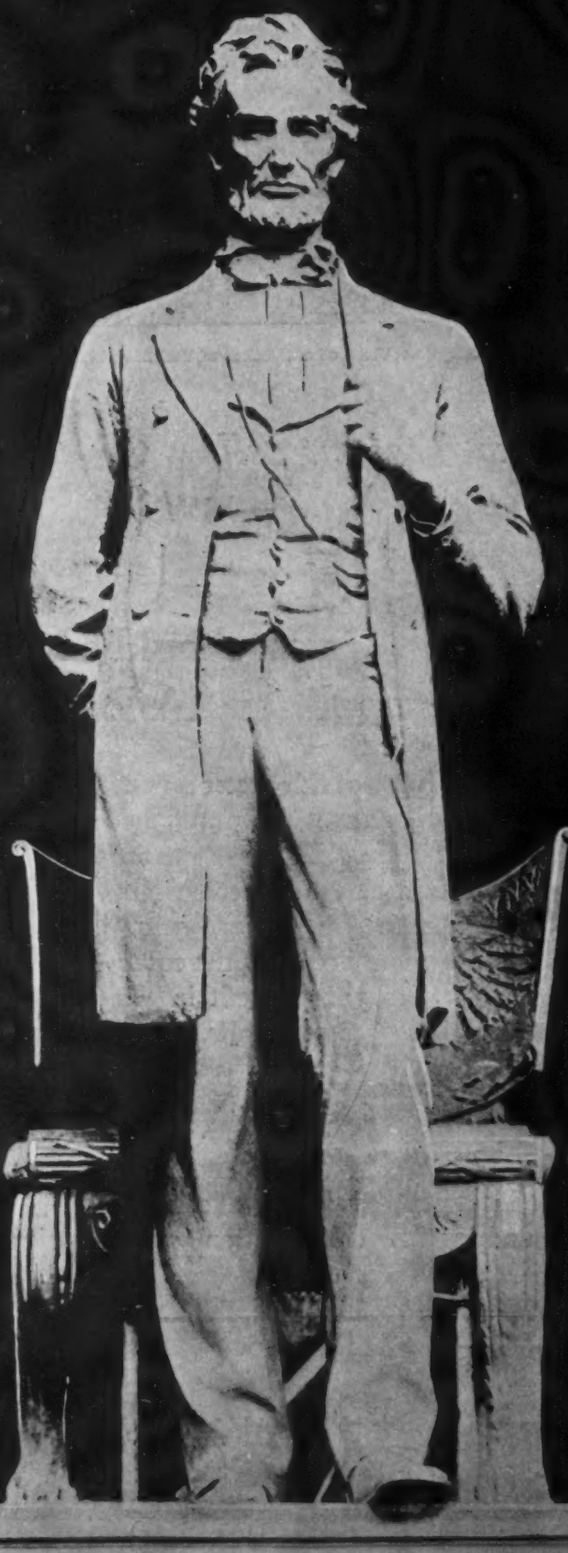


LET US HAVE FAITH THAT RIGHT MAKES MIGHT · · AND IN THAT FAITH LET US TO THE END, DARE TO DO OUR DUTY AS WE UNDERSTAND IT."

—*Abraham Lincoln*

SO WITH SANGAMO THIS CREED OF LINCOLN · FRIEND AND COUNSELOR TO MANY OF THE FOREFATHERS OF SANGAMO MEN · HAS INSPIRED US WITH FAITH THAT QUALITY MUST TRIUMPH · IN THAT FAITH WE WILL GO FORWARD TO THE END IN OUR SERVICE TO THE INDUSTRY.

SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

LINCOLN

Independence Hall

Airplane View of a Section of Philadelphia

Delaware Station

To minimize that now frequent call

"The Lights are Out"

you should also approve Metropolitan AA Rotary Meter Switches

Metropolitan Rotary

Open Position

The purpose of this meter switch in addition to its protection against tampering is the fact that your customers can, in a 100% safe operation, renew fuses without breaking the cover seal—all to your benefit in the reduction of service calls.

Classification AA is the highest Underwriters' rating,—to quote:

"Enclosed switches coming under this classification must necessarily be so designed that the fuse terminals are disconnected from both line and load terminals when the switch is open and the fuse exposed for inspection or replacement."

In the interest of economy, safety and the building of Public Good Will, you should also approve it. Write for full data and miniature working model.

METROPOLITAN DEVICE CORPORATION
1250 Atlantic Avenue, Brooklyn, N. Y.

Gentlemen: Please send full information with miniature model of the Metropolitan AA Rotary Meter Switch.

Name..... Company.....

Electrical World

THE CONSOLIDATION OF ELECTRICAL WORLD, ELECTRICAL ENGINEER AND AMERICAN ELECTRICIAN

Published by McGraw-Hill Company, Inc.

W. H. ONKEN, JR.

Editor

VOLUME 85 — *New York, Saturday, February 7, 1925* — NUMBER 6

Operating Companies Must Look to Their Load Curves

THE ingenuity of executives and operators of electric light and power companies has been concentrated on methods of keeping down the cost of service. That success has attended the effort the records show. How the result has been accomplished is also fairly well known, for interconnection and superpower have been on the lips and in the minds of many during the past ten years. The industry has faced a situation where new business has come in such volume that more attention had to be paid to raising the necessary funds to supply the service than to the characteristics of the business connected.

Meanwhile, however, another set of conditions has come to the front. Executives and engineers now realize that new power stations cannot be built at former prices, nor are they likely ever to be. It means that greater use must be made of the investment if rates are to remain the same, and this, translated into operating parlance, suggests better load factors on generating systems. Naturally the job of getting better load factors is up to the new-business department, and to get them calls for salesmanship on the part of the solicitors; but get them the electric light and power industry must. Editorially, the ELECTRICAL WORLD has been at work on the problem for some time, and when the heads of the sales departments of electric light and power companies sense its importance they, too, will not grow weary in well doing. The crisis may not confront many systems in the immediate future, but of this the industry everywhere may be assured, it is on its way.

Central-Station Industry Should Advertise Itself

THE statement that the electric light and power industry should advertise itself will be received with a smile. Is it not the most advertised industry in the world? In fact, as the manufacturer of such a universally accepted and desired product as electricity, does it need much advertising? It is smug complacency of this sort that handicaps. True, the electric light and power industry advertises; but what? Flatirons, washing machines, vacuum cleaners, toasters and milk warmers. Its showrooms and show windows are beautifully decorated with portable lamps, sewing machines and numerous household labor-saving appliances; but rarely can one find a word concerning what the industry is and stands for and what it means to the community.

The former type of advertising is good in its way and should be done. We have not one word to say against it. But the primary function of an electric light and power company is to manufacture and distribute electricity, and that should never be forgotten, nor should the industry permit the consuming public to overlook it. It is institutional advertising that the industry lacks. The telephone industry offers excellent examples. "Don't travel, telephone," may be hard on the transportation companies, but it is excellent advice nevertheless. It sells telephone service. Vacuum cleaners, washing machines, flatirons and electric devices of every kind are excellent. They should be advertised. They bring comfort to the user and profit to the manufacturer, but they do not necessarily sell the company to the community, and the electric light and power industry needs more advertising of the kind that will do this. Appliance advertising should be done, but institutional advertising should not be left undone.

The Stability and the Structural Problems in Transmission

MUCH brain power and much experimentation are being used to determine the stability of long transmission lines under various operating conditions. These studies and experiments have resulted in differences of opinion and of fact between the specialists working in this field which are largely accounted for by the differences in the assumptions made and the approximations used in arriving at conclusions. There are so many factors in the equation to be determined accurately that it becomes impossible of solution without making assumptions and approximations.

No doubt a solution to long-line stability is highly desirable, but many practical considerations enter into the commercial application of the theoretical principles, and fortunately these nearly all favor stable operation. The inertia of machinery and of lines, the cushioning effect of the long system when subjected to sudden changes, the improvement in line and machine design characteristics are favorable factors which usually result in a line's having more stability than was calculated. In every case of practical experience long lines and interconnected systems have been found very stable —in fact, more so than the short, rigid, closely linked systems encountered in metropolitan areas—and these long lines are very readily made more stable still by the addition of loads, synchronous condensers or branch lines at desirable points. Thus the stability problem is more fancied than real in most cases, and, while specialists should study this problem thoroughly, greater problems face the transmission engineer in practice. For example, an experience with a sleet storm shows many structural problems to be solved, and there are other problems connected with insulation, relaying, switching and maintenance which should have equal consideration with those concerned with system stability. All these big problems in high-voltage transmission should be attacked with equal diligence.

"Punishment First—Trial Afterward"

THE palm for brilliancy in thinking up new laws for the regulation of public utility companies must be awarded to the Community Civic Clubs of Indiana. Just how many and which citizens of the Hoosier State these clubs represent we know not—that does not affect the merit of their suggestion, which is simply that before asking in the United States courts for increased rates on the ground that existing ones are confiscatory, public utility companies shall apply to the state courts for a receiver. Why not apply this principle to all business? Let the raising of prices be prohibited by law unless preceded by compulsory bankruptcy. That commodities once manufactured or sold with a reasonable profit at a certain price could no longer be made or disposed of at that price without a loss would then compel the maker or seller either to become a charitable institution or to make an assignment. Could there be an easier method to prevent rising prices and keep sugar, clothes, meat and automobiles from "going up"? It has all the perfection and simplicity that attach to the scheme for bringing about a more even distribution of riches by limiting the amount any individual may earn or accumulate, or that other plan—lately tried so successfully in some European countries—of making everybody rich by the unlimited issue of paper currency. It reminds one also of the famous method of administering justice that prevailed behind Alice's looking glass—"punishment first, trial afterward."

The Curse of the Courtesy Discount

IT IS pretty generally conceded that the so-called courtesy discount has become a curse to the electrical industry. For it has grown to be a custom that any employee of any electrical organization who is known or will show his card is entitled to the trade price on whatever he wants to buy for his personal use. It is but natural that this privilege should also be seized upon by friends of electrical men who innocently ask, "Can you save me any money on a flatiron—on a radio?" The result is that courtesy to a thousand electrical men scattered about may in the end affect the purchases of five thousand households that should be the profitable customers of the regularly established retailers.

Now, there is nothing more greatly to be desired than that the electrical retailer should prosper. The manufacturer and the jobber of appliances and accessories that are sold to the public both realize that the lack of an adequate number of well-kept retail stores run by clever, able, active merchants who create a local market by all the artifices of modern merchandising is a serious obstacle to the rapid development of household demand. The reason why the electrical industry develops this type of electric shop so slowly is because the electrical dealer has not made enough money in most cases to attract large numbers of expert merchants to this field. And one of the reasons why the dealer finds it hard to make money is because the million men and women now employed in the electrical industry are sucking the blood out of the retail trade by demanding "courtesy discounts" on everything they buy for themselves or for their friends. These people are, of course, the most active buyers of electrical merchandise.

It is time this evil was stamped out, and the central-station company can take leadership by pledging its own employees to pay full value for electrical purchases and urging upon the local dealers a policy of one price to all. The manufacturer can put pressure upon his jobbers to the same end, and both in turn upon the retailer, and both can also pledge their own employees. Public opinion within the industry can right this wrong.

Getting the Engineer and the Artist Together

EFFICIENCY is an excellent virtue, and more of it is needed in many places, not forgetting government, of course. A rare case has arisen, however, where the efficiency viewpoint is overdone and has caused much antagonism. It concerns fields of lighting where the esthetic considerations dominate the utilitarian ones, as in some rooms of the home and in hotels, clubs, restaurants and many other places.

The field of lighting was naturally acquired by the engineer, because in the early years of gas and electric lighting efficiency was paramount in order to conserve the light, which at best was meager. But the cost of light has enormously decreased in the past half century, and at the present time those who use it can well afford to utilize its esthetic effects. The training of the engineer emphasizes efficiency in almost every direction, but it is sometimes deficient in the matter of esthetics. Many men of engineering ability can lay little claim to artistic taste. Failure to realize this deficiency and to ascribe importance to esthetic considerations has not only hampered the proper development of lighting in certain channels where the engineer has had complete control, but also has more or less antagonized the architect, interior decorator, designer and others with whom the esthetic phases of lighting are dominant.

The two groups are still far apart, and neither deserves criticism more than the other. Lighting in the fields mentioned should be based fundamentally upon efficiency except where a reduction in efficiency is more than repaid by added charm. On the other hand, the architect and others should utilize fully the possibilities of modern lighting instead of lagging behind with principles retained from the relatively dark ages. They should not insist upon fixtures to which modern electric lamps cannot be adapted without sacrificing eye comfort and much of the potentiality of modern artificial light. One cannot approve of archeologists dictating esthetic lighting any more than one can uphold the engineer who does not appreciate the importance of beauty.

If individuals in these two groups persist in remaining apart, we suggest that the engineer be made to practice in his home efficiency in its narrowest sense. We would have him sit on a cracker box while his dinner is served on a larger one. We would leave his walls barren of decorative coverings and would take away the draperies and other beautifying effects. On the other hand, we would take away from the home of the architect and the others of his group the electric service, the heating plant, the bathtub and many other modern conveniences, because we are sure that, skilled archeologist though he may be, he could find no prototypes of them in the past ages in which he is so prone to practice lighting. When both engineer and architect applied for a remission of penalty we would require

each to write an essay on this thesis: "Efficiency is the ratio of satisfactoriness to cost"—with particular attention to its application to lighting in the home and in other fields in which utilitarian and esthetic considerations are intricately interwoven.

Radio Interference—An Obligation and a Danger

THE central-station companies of the country face a new problem, rapidly gaining in importance in large cities and populous centers, in the form of power-line interference with radio broadcast reception. In localities where the interference is at its worst public sentiment is growing so rapidly that doubtless something will soon be done in an effort to improve conditions. The question is whether the power companies shall take the initiative in this endeavor or whether this should be left to outside interests.

In any approach to the problem, of course, the central station faces the fact that power-line interference is something which in no wise affects the delivery and sale of its commodity. If responsibility for stopping all such interference is to be hastily and unwisely assumed, maintenance expense might soon be increased beyond reason without any increase in revenue.

The power companies with few exceptions have taken a fair-minded attitude toward the situation. They have been ready and willing to co-operate in every way possible, and there can be no complaint on this score. However, in the search for leaks and grounds they have been groping in the dark, largely from the lack of proper apparatus and methods of locating the trouble. The inductive-co-ordination committee of the National Electric Light Association has this year undertaken to gather data on successful methods and apparatus for locating power-line leaks, and much good will no doubt come from these efforts. The situation is such, however, that central-station executives would do well to recognize the problem and prepare individually to cope with it if a serious situation in public relations is to be avoided.

The larger utilities might be warranted in assigning the problem to a competent radio engineer in the employ of the company. The government's district radio inspector should be willing to co-operate in every way possible, and advantage should be taken of his knowledge and experience. The type of radio compass set used by the radio inspector might be used to advantage. In a few instances central-station companies—notably the Boston Edison company—have developed suitable apparatus for locating trouble on power lines, and the experience of such companies should be of value. Some study should be made of the application of resonance drain coils to drain off the radio-frequency increment on power lines. A substation device to detect the presence of radio frequency on feeders offers possibilities. These are only a few of the possible lines of research.

However, whatever methods may be found best, and aside from all questions of how the costs of doing the work are to be met, it should be remembered that this is a subject involving public relations in a most vital form. The number of radio listeners is now in excess of thirty millions and is increasing at an incredible rate. Just as radio provides a means of reaching an enormous audience in the quickest and most direct manner, so does it become an equally potent agency for stirring up antagonism toward the power company where power-line interference, or what is believed to be such, causes annoyance. So long as power-line interference is known to exist and no determined effort to stop it has been announced, many listeners on the radio will blame the power company for static, tube or battery noises or other troubles.

Interference with radio reception under certain conditions can arouse in a few minutes more antagonism than can be offset by months of campaigning to promote desirable public relations. The problem is already serious enough to command attention. Whatever results attend the central station's first action on this problem, the earliest opportunity will be none too soon to tell the public that the company is making every endeavor to do its part in clearing the air.

Use of Off-Peak Energy for Manufacture of Carbon Black

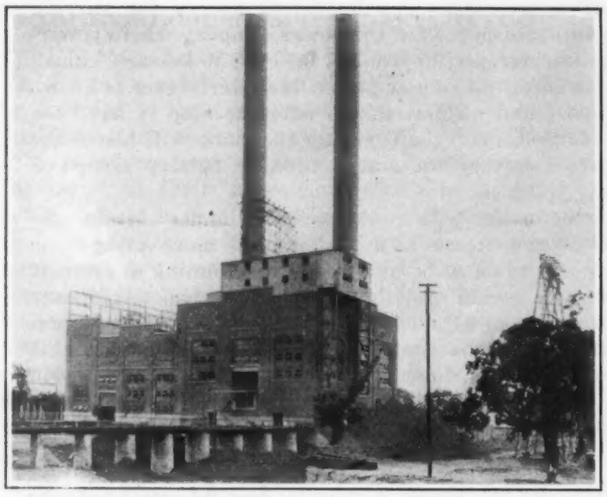
A RECENT investigation by J. J. Jakosky on manufacture of carbon black from oils by the electric arc process (which is obtainable for ten cents from the Superintendent of Documents at Washington in the form of Technical Paper 351 of the United States Bureau of Mines) deserves more than a passing notice on the part of electric utilities and of industrial plants which have abundance of off-peak power to dispose of. The process is suitable for non-continuous or intermittent operation, and this, if commercially successful, will constitute a very desirable application of electricity for filling of valleys of the load curve. It also appears that valuable byproducts could be obtained in the manufacture of carbon black.

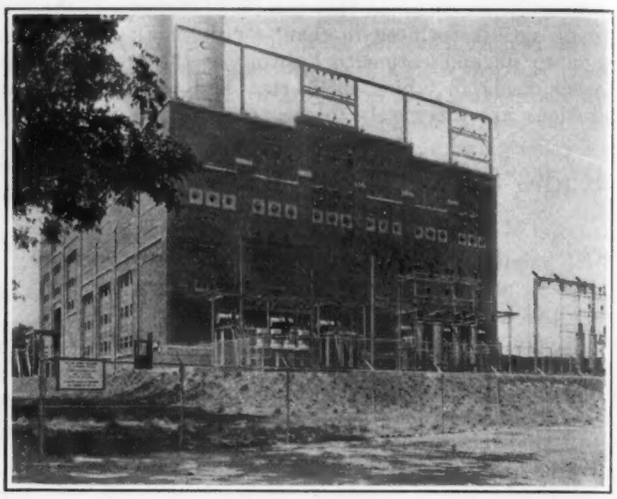
Carbon black is used extensively in the making of printers' inks, as a filler in automobile tires and in the manufacture of stove and shoe blacking, phonograph records, black leather, typewriter ribbons, carbon-copy papers, carriage cloths, oilcloths, linoleum, black opaque photographic papers, celluloid cement, wall tints and colors, marking inks and pencils, and artificial tile. About 15 to 25 per cent of it is exported for use in the same industries as in this country. Large quantities go to England, France and Germany for rubber compounding and to Japan and China for manufacture into "India" and other inks, paints and enamels.

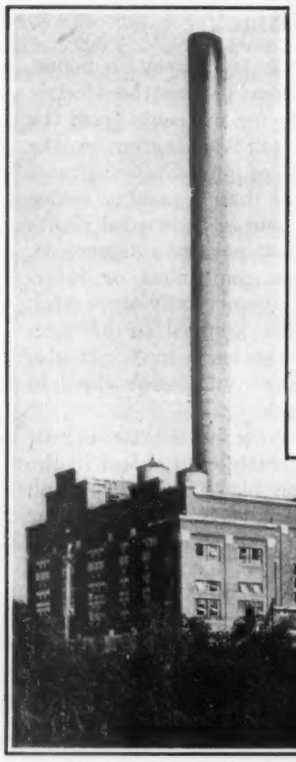
In certain states the decreasing supply of natural gas and the drastic legislation against carbon-black plants have prevented the expansion that would be economically justified by the increasing use of carbon black in the industries and the gradual rise in price for the better grades of black. At present Louisiana is the center of carbon-black production, and it has to be shipped comparatively long distances to the chief markets at freight rates that are high because of the bulkiness of the material.

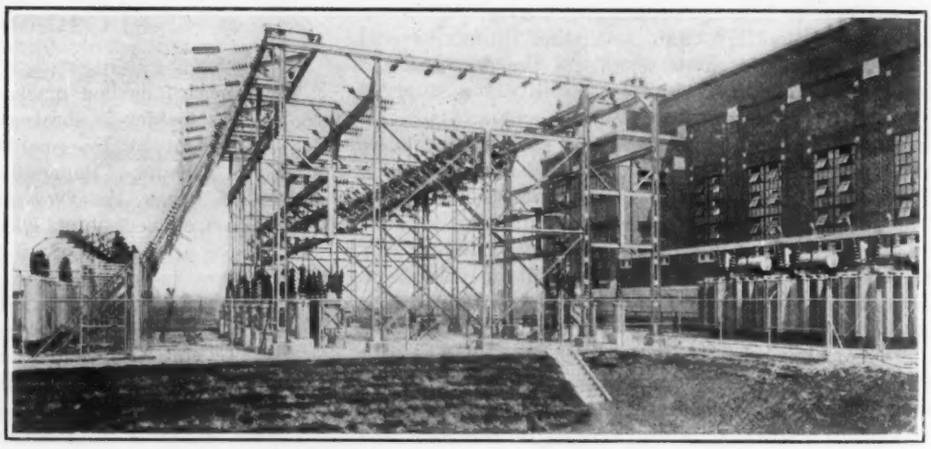
It would seem, therefore, that there is here a product for which there is a steady and established market and which will have to be manufactured in the future by the use of electrical energy, or else its production will shift to other countries with unregulated use of natural gas. The leaders of the electrical industry should take this opportunity in hand and establish at least a few experimental or model plants for making carbon black, in order later to be able to urge with confidence the use of electricity for this purpose on a large scale.

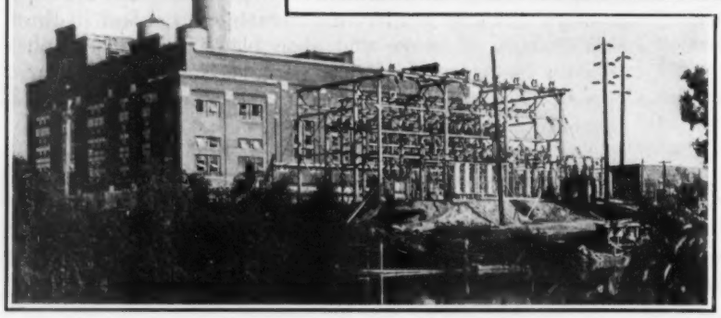
New Oklahoma Stations











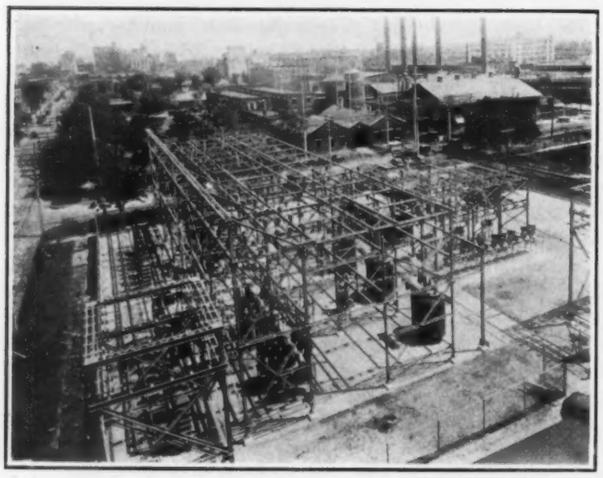
THE development of Oklahoma has proceeded very rapidly of late because of the oil discoveries and the utilities have been kept busy building plants to keep up with the demands for power.

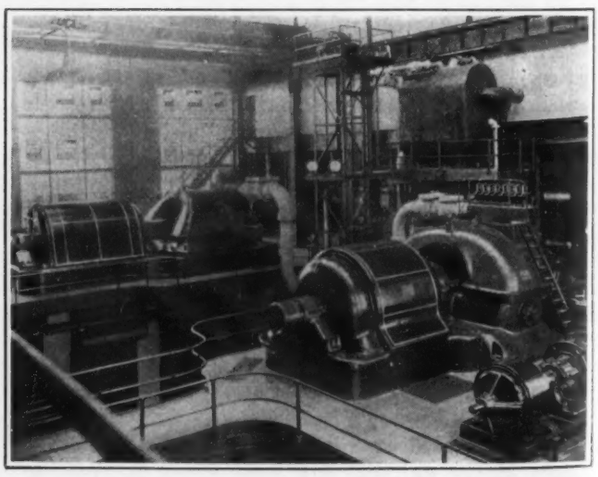
At Top—Exterior of Riverbank station and step-up transformers.

In Center—Exterior of Horseshoe Lake station and outdoor switching structure.

At Bottom, Left—Receiving terminal at Oklahoma City.

At Bottom, Right—Turbine room of Riverbank station.





Design of 65,000-Kva. Generator

Requirements Imposed by Desire to Economize Space and Highest Efficiency Consistent with Reliability Were Chief Considerations in Design of Niagara Falls Unit—Results of Overspeed and Performance Tests

By R. B. WILLIAMSON
Engineer in Charge of Alternating-Current Design, Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

DURING the past year the Niagara Falls Power Company has put into regular operation three 65,000-kva. generators each coupled to a 70,000-hp. hydraulic turbine. These units, the largest of their kind built so far, are situated in an extension of No. 3 station and are known as Nos. 19, 20 and 21. The generators for Nos. 19 and 20, built by the General Electric Company, have been fully described;* the purpose of this article is to present information regarding generator No. 21. This unit, including both hydraulic turbine and generator, was built by the Allis-Chalmers Manufacturing Company and put into regular service in September, 1924, thus completing the work of extension which has been under way for over two years.

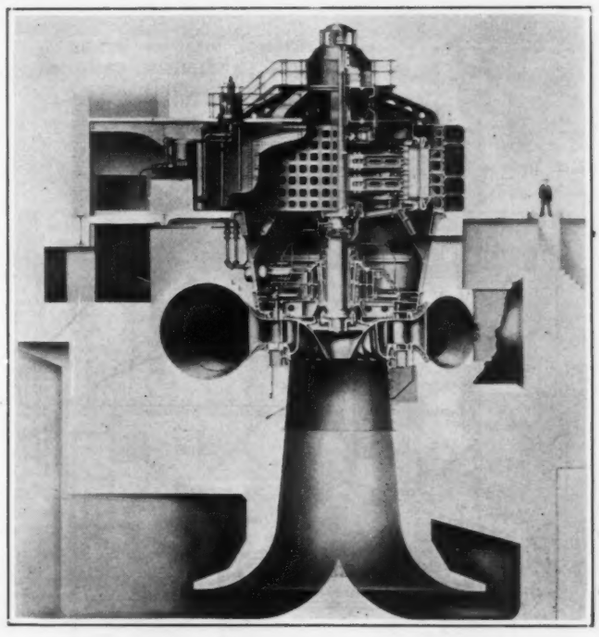
In the same station three 32,500-kva. generators were installed during 1919-1920. At that time these were the largest hydro-electric units in operation, so that within the brief period of five years the size of the units in this power house has been doubled. The 32,500-kva. machines proved very satisfactory and are highly efficient. However, in planning the latest extension it was found advisable to use larger units on account of the saving in space. Reference is made here to the 32,500-kva. machines (units 16, 17 and 18) because No. 16 is compared with the 65,000-kva. generator in the table.

In the design and construction of the 65,000-kva. generator one of the chief objects was to obtain high efficiency without sacrificing reliability or departing from well-tried construction. On account of the high efficiency aimed at and the necessity of operating over a considerable voltage range, the field windings are more liberal than is customary. The power required for excitation at 12,000 volts and full kva. at a power factor of 0.8 is only about four-tenths of 1 per cent of the output—a low percentage for such a low-speed machine. Special efforts were also made to reduce the windage loss by using shrouding on the fans and spider arms. Non-magnetic materials were also used in certain parts as described later in order to reduce stray loss. Aside from these features the design in general is much the same as that of other modern large hydro-electric units.

The complete unit—waterwheel and generator—is of the vertical close-coupled type with thrust bearing carried by the upper bridge and with a single guide bearing below the thrust bearing. The other guide bearing, of lignum vitæ, is carried in the turbine cover plate. The generator follows the usual construction, employing an internal revolving field and external stationary armature supported by a box-type yoke cast in eight sections.

*"The 65,000-Kva. Generator of the Niagara Falls Power Company," by W. J. Foster and A. E. Glass, *Journal of A. I. E. E.*, April, 1924.

The machine is rated at 65,000 kva., 12,000 volts, 3,127 amp., 25 cycles and 107 r.p.m., but it has to be capable of carrying its full rating at 13,200 volts. On this account the saturation at normal, 12,000 volts, is relatively low. Since the rotative speed is low and the peripheral speed moderate (7,650 ft. per minute), a 25-cycle machine of this output is naturally very large and heavy, and the mechanical features of the design, worked out under the direction of A. J. Brown, required an unusual amount of consideration. As shown later, however, the weight per kva. output is not high and compares favorably with that of many 60-cycle machines running at about the same speed.

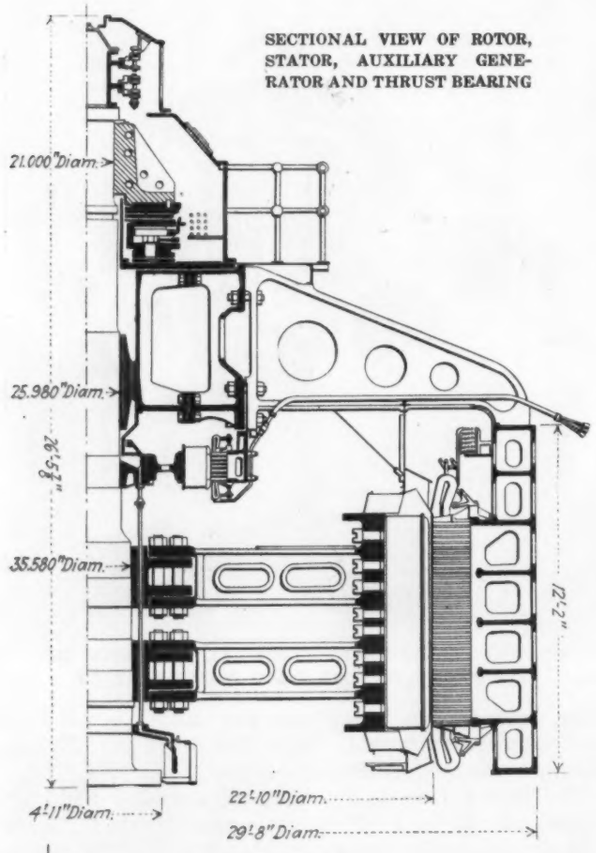


VERTICAL CLOSE-COUPLED 65,000-KVA. GENERATOR AND TURBINE OF NIAGARA FALLS POWER COMPANY

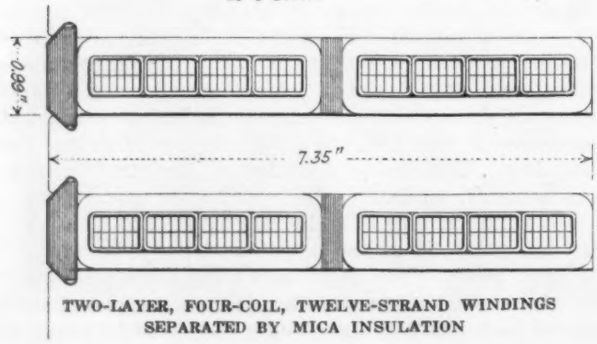
The stator core is built up of annealed and varnished punchings held by projecting dovetails fitting into grooves in the ribs of the stator yoke. The punchings were compressed by jacks during the process of stacking and clamped between heavy cast manganese-bronze end finger plates. Manganese-bronze clamps were used on account of their mechanical strength and non-magnetic qualities, the latter helping to reduce the stray loss. The inside diameter of the stator punchings is 22 ft. 10 in.

The winding, which is distributed in 420 slots (fifteen per pole), is of the usual two-layer type with 80 per cent pitch. The coils have four turns each and are connected in seven parallel circuits per phase, both ends of each phase being brought out so as to admit of

PART OF COMPLETED WINDING WITH ALL CONNECTIONS BETWEEN COILS AND PHASES AT TOP



SECTIONAL VIEW OF ROTOR, STATOR, AUXILIARY GENERATOR AND THRUST BEARING



TWO-LAYER, FOUR-COIL, TWELVE-STRAND WINDINGS SEPARATED BY MICA INSULATION

balanced relay protection. The conductor is built up of twelve strands separated by mica insulation to reduce eddy currents, all coil insulation being of mica applied in the form of tape. Each stator coil, completely insulated, weighs approximately 141 lb. It is interesting to note in passing that the output generated per coil is 155 kva. The projecting ends of the coils are also insulated with mica, the same insulation as used in the slot being carried uniformly around the ends. All coils were vacuum-treated and molded both in the slot part and on the ends, thus insuring an insulation free from air spaces but at the same time sufficiently flexible when heated to permit winding without danger of damage. Coils were heated in an oven before being placed in position, and the whole winding was again heated by passing current through it before the slot wedges were driven into place. The complete winding was subjected to a test of 27,400 volts for one minute and during this test showed remarkable little corona or distress of any kind.

The coils are assembled in slots with ¼-in. insulating filler pieces between upper and lower layers. Twenty-four resistance-type temperature detectors are provided in the center of the core between upper and lower coil sides and spaced at approximately equal intervals around the circumference. To brace the projecting coil ends and prevent distortion in case of short circuit, the coils are blocked at the points where they project beyond the core and the ends are corded back against blocking supported by bronze brackets bolted to the core finger plates. The design of these brackets is such as to eliminate as far as possible closed circuits in which the stray flux might set up currents. The diagonal parts of the coils are braced by blocking corded between the coil sides. All connections between coils and phases were made at the top of the machine.

DESIGN OF ROTOR

On account of the great size and weight of the rotor, the mechanical construction had to be considered very carefully and several alternative designs were worked out. It had to withstand an overspeed test of 100 per cent (214 r.p.m.) without exceeding in any part a stress of approximately one-half the elastic limit of the material. To permit transportation it had to be sectionalized, and the design finally adopted is indicated in the accompanying illustration. It is made of two wheels, each comprising seven sectors having two arms cast integral with the rim. These are bolted to a solid cast-steel hub by means of reamed bolts passing through the ends of the arms and the two hub flanges. The joints between the sections of the spider rim were made by heavy forged-steel tongues running through the full width of the rim and large dowels driven through the rim and tongue. This construction had previously been used very successfully on a number of large rotors for 60-cycle generators. The straight tongues and dowels enable the stresses at overspeed to be handled without difficulty, and they do not introduce bending stresses in the rim as would the shrunk arrowhead type of tongue.

A departure from the usual construction has been made in the pole pieces in that the body of the pole is solid instead of laminated. The pole body is made of rolled steel machined to size and dovetailed to receive

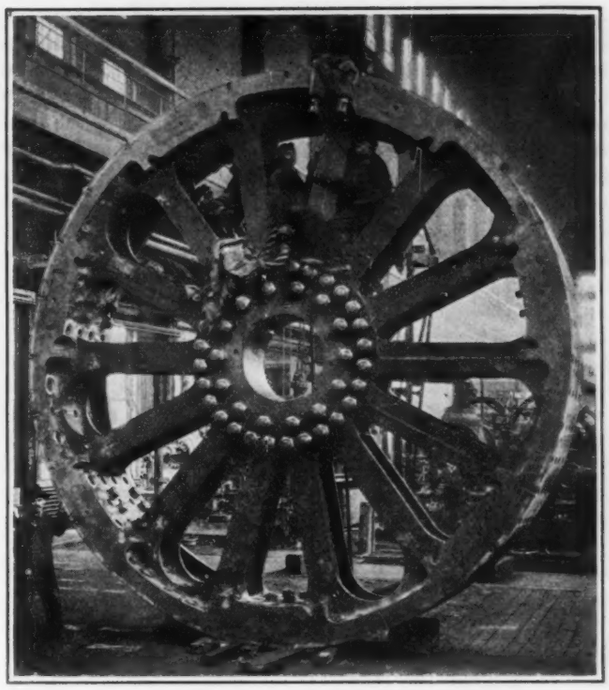
the pole-face punchings. After the pole-face laminations are stacked in place, they are clamped by heavy cast-steel end plates bolted and doweled to the pole body. These poles are so long and heavy that the solid body is an advantage on account of its rigidity and also because it permits fastening the poles to the rim by means of heavy bolts. Dovetailed poles were considered in working out the design, but the bolted construction proved better in this case, largely because of the low rotative speed of 107 r.p.m. By using bolts excessively long tapered keys were avoided and the necessary thickness and weight of rim reduced.

Since the field copper is very heavy (0.4 in. x 3 in.), bending of the material on edge presented quite a problem. It was finally solved by the development of special apparatus which bent the copper and removed the upset material on the inner radius of the bend, thus making the copper of uniform thickness throughout. The field coils are insulated with mica and asbestos between turns, the total weight of copper per coil being 2,750 lb. Pole collars are of cast aluminum, insulated with molded-on mica tape, and the coils are drawn down against spring supports to make sure that they will remain tight. The field coils are held sideways against distortion by V-shaped clamps between the coil sides. Holes drilled through the spider rim between coils allow air circulation for field ventilation.

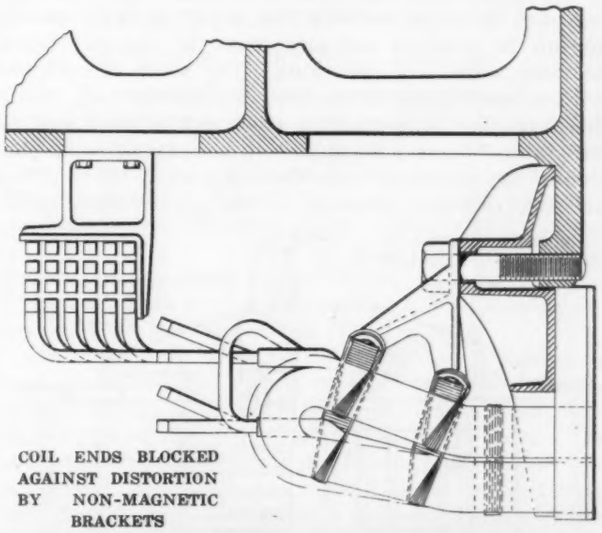
Every precaution was taken to obtain specially sound and well-annealed steel castings for the rotor spider. The sectors were cast with unusually large risers; in addition to the usual coupon test bars, bars were taken from the body of the rim for test. In every case these samples showed freedom from crystalline structure, and the elongation and reduction of area were comparable to that of forged material. A 1-in. x ½-in. bar, planed from one of the tongue grooves, was bent flatwise 180 deg. around approximately 1½-in. radius without fracture. The large number of holes drilled through the rim for the pole bolts, ventilating openings and dowels afforded an exceptionally good opportunity to inspect all parts of the castings, and all of the fourteen sectors were found to be free from flaws or shrink holes of any kind.

Water Coils Cool Thrust-Bearing Oil Bath

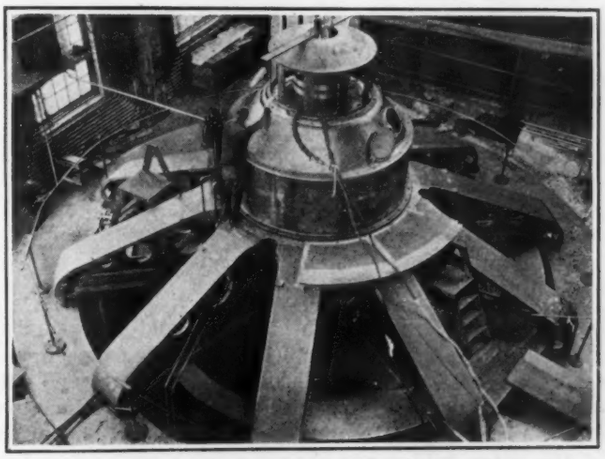
The Kingsbury thrust bearing (69 in. in diameter) is designed for a total suspended load of 1,250,000 lb. This is more than sufficient to take care of the weight of all the generator and turbine revolving parts plus the downward hydraulic thrust of the water. The bearing is submerged in an oil bath in the bearing housing and mounted on an insulated base to prevent shaft currents. The upper bridge is also insulated from the stator yoke to prevent stray currents from circulating through the guide bearing. The thrust-bearing oil bath is cooled by circulating water through copper cooling coils immersed in the oil. This system of cooling gives results as good as circulation from a central system and saves a large amount of piping, besides reducing the danger of getting dirt into the oil. The guide bearing is arranged to be supplied with oil either from the central oil system or from two oil pumps mounted in the lower oil pan. Under normal conditions oil is supplied from the central system and the pumps are used only in case of emergency. All oil piping is joined with bolted flanges which are brazed to the pipe or put on with an expanding tool, thus avoiding oil leaks.



ROTOR CONSISTS OF TWO SEVEN-SECTOR WHEELS DESIGNED FOR HALF ELASTIC LIMIT AT DOUBLE RATED SPEED

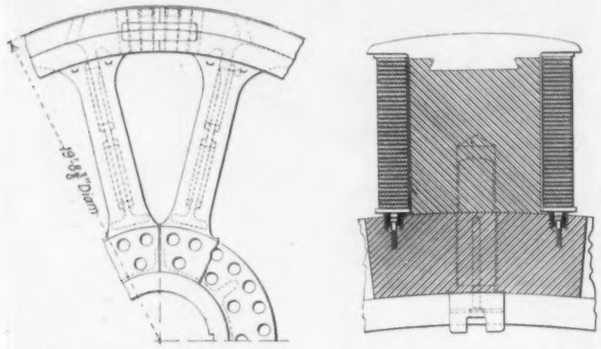


COIL ENDS BLOCKED AGAINST DISTORTION BY NON-MAGNETIC BRACKETS



ROTOR BEING TESTED AT DOUBLE RATED SPEED

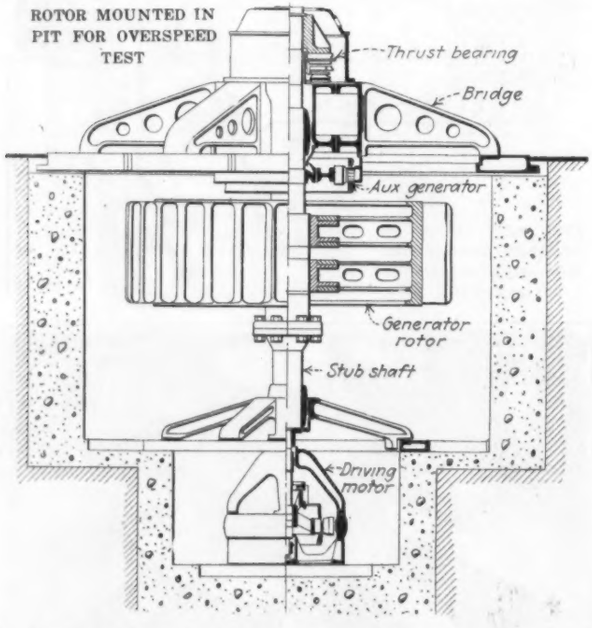
Air-operated brake cylinders are carried in a lower support which rests within the cast-iron barrel connecting the turbine and generator. These cylinders force brake shoes against the lower finished surface of the rotor whenever air pressure is applied. The conical support is of great strength and capable of holding the total weight of the rotating parts in case it is necessary to jack up the rotor for removal of thrust-bearing shoes, etc. Manholes in the lower support give access to the brakes and lower parts of the generator.



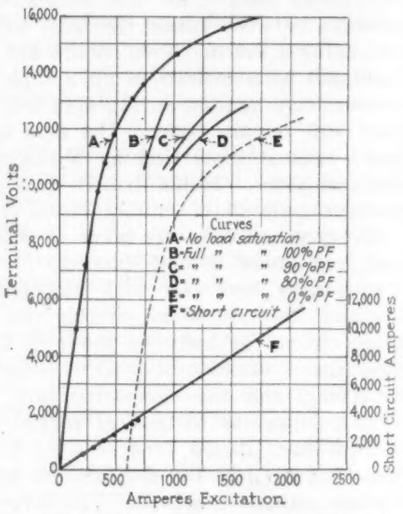
AT LEFT—HEAVY FORGED-STEEL TONGUES RUNNING THROUGH FULL WIDTH OF RIM BETWEEN SECTORS ARE HELD IN PLACE BY LARGE DOWELS. AT RIGHT—LAMINATED POLE-FACE PUNCHINGS DOVETAILED TO SOLID POLE BODIES

Air is drawn from the generator room through screened openings between the upper spider arms on top of the machine and also from the chamber below between wheel and generator. The rotor is equipped with shrouded steel-plate fans, top and bottom, which discharge air into pressure chambers at each end of the stator. From these chambers a relatively small portion of the air passes over the end part of the winding and out through openings in the yoke. Most of it, however, is forced between the poles and out radially through the ventilating ducts in the stator core. Some also passes between the spider arms of the rotor and out between the poles through radial holes in the rim, this aiding materially in cooling the field coils. The arms of the rotor spider are shrouded with plate steel for about two-thirds of the distance from the inside of the rim toward the hubs in order to reduce windage loss. The air discharged from the stator yoke passes into a steel-plate casing surrounding the machine, from which it is exhausted by two motor-driven fans into ducts leading out of the building.

ROTOR MOUNTED IN PIT FOR OVERSPEED TEST



For providing excitation and also for the operation of all auxiliary motors connected with the unit, a 650-kva., 2,300-volt auxiliary alternator is mounted under the bridge, the stator being bolted to the bridge and the rotor keyed to the upper revolving oil-pan casting. This novel arrangement for obtaining auxiliary power for a unit of this kind is due to J. Allen Johnson, electrical engineer of the Niagara Falls Power Company. A direct-connected direct-current exciter for a unit of this size operating at 107 r.p.m. would not work out well for automatic voltage control. By using the auxiliary alternator to run a relatively high-speed motor-generator exciter set, this difficulty is overcome and alternating current is also obtained for operating the various auxiliary motors from a source unaffected by any disturbances that may arise on the system. The unit was put into full-load service during September, 1924, and has been running regularly since then. Final tests have not as yet been made, but curves are presented here showing the saturation and excitation determined from preliminary tests. The short-circuit characteristic was obtained by short-circuiting the lines at the switch house at the top of the cliff above the power house so that the impedance of these lines is involved in the results presented.



NO-LOAD AND FULL-LOAD SATURATION CURVES AND SHORT-CIRCUIT CHARACTERISTICS OF 65,000-KVA. GENERATOR

Under full-load conditions the heating of the generator is very moderate. A preliminary test with load ranging from 66,563 kva. to 63,660 kva. at a power factor of 0.781 to 0.817 and a voltage of 12,600 to 12,700 showed temperatures (indicated by embedded detectors in the center of the stator core) ranging from 58.9 deg. C. to 65.1 deg. C. The average incoming air temperature at the top and bottom of the generator was 24.1 deg. C., thus giving temperature rises of 34.8 deg. C. minimum to 41 deg. C. maximum. Under the same conditions the temperature rise in the projecting end portions of the winding (as indicated by temperature detectors) ranged from 21 deg. C. to 29 deg. C. So far as temperatures are concerned, the machine could have been made with considerably less copper in the stator; but efficiency was the determining factor and the copper loss had to be kept down as low as possible without interfering with the design in other respects.

Specifications for the generator called for an overspeed test at double speed (214 r.p.m.) to be made at the factory and witnessed by the customer's engineer. The rotor with its shaft and other rotating parts weighs 670,000 lb. and is, so far as we have been able to find,

WEIGHTS OF THE PRINCIPAL PARTS OF 65,000-KVA. NIAGARA FALLS GENERATOR

(For purpose of comparison corresponding weights of the 32,500-kva. machine, unit No. 16, are given.)*

	Unit No. 21, 1924	Unit No. 16, 1919
Kva.	65,000	32,500
R.p.m.	107	150
Volts	12,000	12,000
Stator complete, lb.	449,300	230,000
Rotating parts, complete, lb.	670,000	263,500
Bridge with thrust bearing, etc., complete, lb.	156,000	64,500
Auxiliary stator, lb.	12,600	none
Total net weight, lb.	1,288,300	560,000
Weight per kva., lb.	19.8	.....
Weight per kva. net, including auxiliary machine, lb.	19.4	17.25
Flywheel effect, WR^2, (lb.-ft.)^2	49,500,000	10,560,000

*No exciter was provided on the 32,500-kva. unit.

the largest and heaviest rotor subjected to such test completely assembled at the factory. The method of mounting the rotor in the test pit to conduct this test is shown. The direct-current driving motor was placed in the bottom and coupled to the generator shaft by means of a special stub shaft. The rotor weight was carried by the generator bridge resting on the base ring around the top of the pit. The Kingsbury thrust bearing furnished with the generator was used in the test. On account of the great weight, it was necessary to build up the rotor on its shaft in the pit, the rotor segments being assembled on the hubs and the poles afterward bolted on. In order to start the rotor it was necessary to pull on it by means of an overhead crane, but once it was in motion no particular trouble was experienced in getting it up to 214 r.p.m. In order not to overload the driving motor, the rotor was accelerated slowly. It required about two hours and fifty minutes to get it up to the overspeed. At 214 r.p.m. the input to the driving motor was 850 kw., and it took one hour and forty-five minutes for the rotor to come to rest from this speed after the power was cut off. An illustration of the rotor running on this test is shown. Careful measurements made before and after the test showed no deformation. A test of this kind involves quite a large expense, but it is the only sure way of determining whether or not a rotor is safe and reliable under runaway conditions that are liable to occur with any hydro-electric unit.

Major Construction in Oklahoma in 1924

Horseshoe Lake and Riverbank Plants Are a Noteworthy Addition to System of Oklahoma Gas & Electric Company

By R. Douglas Foote
Public Relations Department, Oklahoma Gas & Electric Company

With the completion by the Oklahoma Gas & Electric Company of the 20,000-hp. Horseshoe Lake plant, 23 miles east of Oklahoma City, and the 30,000-hp. Riverbank plant, about 3 miles from Muskogee, Oklahoma is well prepared to care for a large increase in the demand for electrical energy. These two stations, with the aid of an 8,050-hp. plant at Byng and about eighteen stand-by and auxiliary stations, supply the needs of both light and power customers in eighty-nine municipalities, besides numerous oil fields, and provide enough reserve power for all the increases in business likely to occur for several years to come. (See page 288 for views of plants.)

The beginning of operation of the Horseshoe Lake plant about the first of August, 1924, completed a construction program involving an expenditure of about $10,000,000, virtually all of which has been carried out during the last two years. The location for the Horseshoe Lake plant was selected because of its connection with the coal fields by a direct Rock Island line and because Horseshoe Lake affords a natural source of circulating water for the condensers. Water from the North Canadian River can be turned into this lake when desired. The plant is situated between the two ends of the horseshoe, which are connected by a tunnel running under the plant. Water is taken in at one end, run through the condensers out into the other end of the lake and around the 3-mile course, so that it is cooled by natural means before being utilized again.

The plant includes a battery of four boilers and automatic stokers. The turbines will receive steam at 300 lb. pressure, the highest of any in the state, and are rated at 20,000 hp. A 50-ton traveling crane which was employed to place the machinery will be available for installation and replacements in the future. The smokestack is 15 ft. in diameter and is lined with concrete. To facilitate receiving coal a one-mile spur of track was built to connect the plant with the railroad. Including the company's land around the plant and lake, there are about 1,000 acres, it being necessary to buy this amount of land to get control of all the lake. The ground not taken up by the plant and lake will be utilized for a recreation park, which will provide swimming, fishing, golf and tennis.

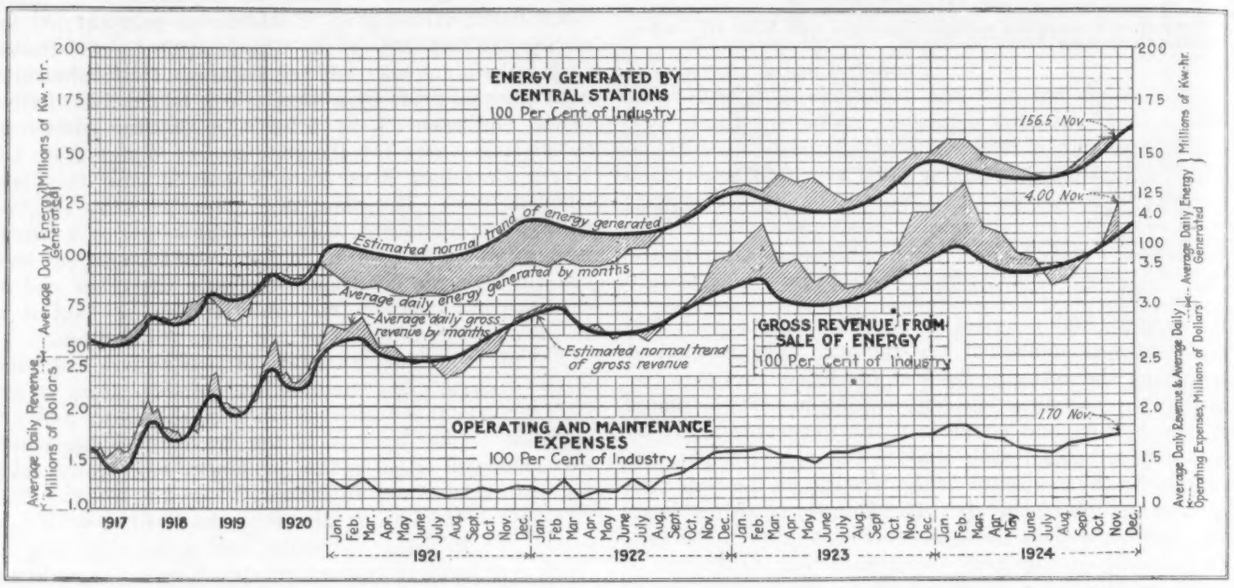
Riverbank Plant Well Arranged

The Riverbank plant was in operation some time before the Horseshoe Lake plant was completed, being "cut in" January 25, 1924. It is on the Arkansas River, near the mouth of the Grand River, about 3 miles from Muskogee, and is one of the largest steam plants in the Southwest. The generating capacity of the plant is 22,500 kw., consisting of two 13,200-volt turbo-generators, one rated at 15,000 kw. and the other at 7,500 kw. Both turbines operate at 225 lb. steam pressure and 250 deg. superheat.

Six boilers are arranged so that there are three on each side of the boiler room with a firing aisle between. Each boiler is equipped with an underfeed stoker and oil burners so that either coal or oil may be used. The coal crusher is beneath a conical-shaped outdoor pit into which the coal is either dumped directly from railroad cars or filled from storage by a locomotive crane. From the crusher the coal is carried by a bucket conveyor to the top of the boiler room, where it is transferred to a belt conveyor, which distributes the coal into steel bunkers. Ashes are dumped into railroad cars run beneath the boilers. There are two 200-ft. self-supporting steel stacks, 14 ft. in diameter, with concrete linings. Cooling water for the condensers is taken from the river through a revolving screen.

Three 13,200-volt, three-phase circuits radiate from this plant, two supplying Muskogee and the third supplying Fort Gibson and the several sand and gravel companies near by. There are also two 63,000-volt circuits which connect this station with the 1,050-mile transmission system operated by the Oklahoma Gas & Electric Company. When the transformer station in Oklahoma City was cut into the main line in June, 1924, Oklahoma City was made one terminal of a 66,000-volt circuit, of which Fort Smith, Ark., is the other terminal.

November Output Under Normal Seasonal Trend


ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
156.5 Nov.
4.00 Nov.
Estimated normal trend of energy generated
Average daily energy generated by months
Average daily gross revenue by months
Estimated normal trend of gross revenue
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
1.70 Nov.
Average Daily Energy Generated Millions of Kw.-hr.
Average Daily Revenue Millions of Dollars
Average Daily Revenue & Average Daily Operating Expenses, Millions of Dollars
Average Daily Energy Generated Millions of Kw.-hr.
1917 1918 1919 1920 1921 1922 1923 1924

CENTRAL-STATION activity during November was considerably below that which would have been expected after the favorable returns for October. The industry failed to keep up to the normal seasonal trend. The amount of energy consumed for lighting was larger than that consumed during October, but the consumption by industrial power customers was not only below that of October but was also below November of last year. The amount of energy that was generated during November was 4.4 per cent above that of November last year.

The industry was, however, operating at exactly normal during November. That is, activities of the industry exactly coincided with the ELECTRICAL WORLD'S estimated normal for that month as shown in the accompanying diagram. Incomplete reports indicate that during December the industry was operating at slightly above normal.

TABLE III — OPERATIONS OF CENTRAL-STATION HYDRO AND FUEL POWER PLANTS IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Energy Generated				Fuel Consumption		
	Hydro Plants		Fuel Power Plants				
	Thousands of Kw.-Hr.	Per Cent	Thousands of Kw.-Hr.	Per Cent	Coal (Short Tons)	Oil (Barrels)	Gas (Thousands of Cubic Feet)
September..	1,472,370	33.0	2,985,054	67.0	2,639,901	1,351,305	5,789,847
October....	1,598,883	33.0	3,217,990	67.0	2,820,610	1,362,166	6,045,769
November..	1,532,543	32.7	3,161,166	68.3	2,914,631	1,104,414	4,541,038

*As collected by United States Geological Survey. The data are for the electric light and power industry only.

TABLE I—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly			Distribution of Energy Generated										Energy Purchased by Public Utilities for Resale, Kw.-Hr.	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intra-Company Business Including Line Losses, Kw.-Hr.			
	1924 Thousands	1923 Thousands	Per Cent Inc.	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands	1924 Thousands	1923 Thousands
September...	*4,457,424	4,186,492	6.3	3,597,424	3,377,492	1,053,000	915,000	2,014,424	1,964,492	530,000	498,000	860,000	809,000	718,000	631,000
October.....	*4,816,873	4,575,007	5.2	3,887,873	3,692,007	1,118,000	970,000	2,222,873	2,207,007	547,000	515,000	929,000	883,000	777,500	638,000
November...	*4,693,709	4,485,208	4.4	3,793,709	3,624,208	1,150,000	998,500	2,116,209	2,127,708	527,500	498,000	900,000	861,000	757,500	626,000

* Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities, minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.

TABLE II—CENTRAL-STATION FINANCIAL OPERATIONS FOR THREE MONTHS IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Gross Revenue from Sale of Energy†			Operating and Maintenance Expenses‡			Operating Ratio					
							Steam Plants		Hydro Plants		Combined Steam and Hydro Plants	
	1924 Thousands	1923 Thousands	Per Cent Increase	1924 Thousands	1923 Thousands	Per Cent Increase	1924	1923	1924	1923	1924	1923
September...	103,300	96,800	6.5	49,700	45,300	9.4	50.8	53.2	29.2	27.8	50.1	46.5
October.....	110,800	100,700	10.2	51,700	48,800	5.7	48.9	52.0	28.7	26.3	48.2	47.1
November...	120,100	112,400	6.8	51,100	48,500	5.3	46.2	50.0	25.0	24.0	45.0	42.3

† Aggregate gross revenue from actual consumers and sales to other public utilities for resale, involving a certain amount of duplication.
‡ Do not include interest, taxes, depreciation or sinking fund.

Ornamental Street Lighting Problems of the Municipality

Installation and Maintenance Costs, Selection and Uniformity of Design and Material Are the Main Factors to Be Considered—Well-Balanced and Harmonious Lighting Scheme for the Entire City Necessary

By R. H. MANAHAN
City Electrician, Los Angeles, Cal.

THE evolution of ornamental street lighting in Los Angeles, from the first installation of 135 posts in 1905 to the present time with more than 8,000 installed or under construction, has developed a number of interesting problems. These problems have not all been completely solved, and new ones present themselves, as might be expected with the evolution of any art.

The first lighting system referred to was placed on the principal business street and consisted of one of the many types of incandescent cluster lighting posts later installed in cities of the Pacific Coast and Middle West. It may be interesting to note that when this system was replaced thirteen years later by a modern type using luminous arcs on 25-ft. standards improvement in lamps produced 3,200 cp., with an expenditure of 1,100 watts per post, as contrasted with the original 192 cp. per post, using 672 watts, providing ten times the amount of light with the same energy.

THE FAMOUS "WHITE WAY," BROADWAY, LOS ANGELES, USING LUMINOUS ARCS

Installation and Maintenance

The first problem developed as a result of the amount of work and difficulty in obtaining from each property owner along the street his proper share of the cost of installing and maintaining the system. This problem was solved by the passage of state legislation permitting assessments to be levied on the property benefited. The procedure adopted was similar to that employed for paving, sewers and other forms of street improvements, the general features of which were already familiar to many of the property owners. No material objection has been made to this method.

The second problem, also arising from the original installation, was that of maintenance. Should the city pay all the cost, and if not, how much? The situation in the average rapidly growing Western city—and, for that matter, in most cities of the United States—relative to appropriations for general street lighting is that they are quite inadequate to provide even moderate lighting. For this reason it was felt that the assumption by the city of the entire yearly cost of maintaining these ornamental lighting systems would materially affect the extension of ordinary street lighting in the other portions of the city. For this reason the city assumes the amount which would be required for ordinary street lighting, and the balance of the cost is assessed against the property owners.

At the present time the amount paid by the city on such systems is based on the cost of operating one 600-cp. lamp at each street intersection, whether those intersections be 300 ft. or 600 ft. apart, either in downtown or residential districts. The writer feels that this basis of cost should be modified as follows:

1. Standards of lighting intensity expressed in lamps per mile of street should be adopted by the city for downtown business, traffic thoroughfares, residential and other types of streets which show distinct characteristics.

2. When ornamental lighting systems are installed on such streets, the city should then assume as its share of the maintenance the cost of lighting with the standard intensity adopted for that particular type of street.

These standards of street illumination could readily be increased from time to time as the needs of the outlying sections were satisfied and additional street-lighting appropriations secured.

Selection of Design

An additional problem arises from the tendency of property owners contemplating improvements of this character to outdo the effects obtained by property owners on intersecting or adjacent streets, their argument naturally being that they are paying the entire expense and should be permitted to use their own money as they desire. This situation, in the opinion of the writer, should be met by a sort of benevolent despotism on the part of the City Fathers laying down the general principle that on streets, particularly busi-

ness and traffic thoroughfares, any one of several designs of ornamental posts may be installed, provided they are the same height to the light center and that approximately the same candlepower lamps are used on streets of similar character.

The present practice in Los Angeles in this respect is the adoption of two-light 25-ft. standards with luminous arcs, 1,000-cp. or 1,500-cp. incandescent lamps in the downtown sections and 17-ft. 6-in. standards on outlying business streets and on traffic boulevards. These latter standards are equipped with two 400-cp. "Mazda C" lamps with cable and auto transformers permitting the installation of 600-cp. or 1,000-cp. lamps as the later development of the particular street may demand.

These installations in the outlying sections are frequently on streets several miles long and in their early stages consist of local zones of one-story or two-story business structures with residential buildings between these local zones. As the growth of these business sections leads to higher intensities of show-window lighting and a larger number of electric signs, the 600-cp. or 1,000-cp. lamps may replace the original 400-cp. lamps in order that there may not be too great a contrast between local lighting and the street lighting in these sections. Tests have indicated that the transition from sections of higher intensity to those of lower intensity within the limits mentioned are not particularly noticeable by either pedestrians or drivers, and the 400-cp. lamp appears to give very satisfactory results on streets of the above type.

The present practice of permitting a variety of designs of posts on streets of the same character is quite different from that indicated by reports of modern installations in many other cities, and the difference results no doubt from the method by which these installations are financed. In a number of those cities where ornamental or "white-way" lighting is of a more recent growth a large area of the city has thus been lighted, the expense of which has been defrayed by general taxation or a bond issue. This has naturally led to uniform designs for the business thoroughfares and residential streets, these posts usually being of the same material and installed under one contract so as to secure uniformity and economy.

There can be no question, from the standpoint of initial expense and future maintenance, that this method will prove more economical. It may be adopted where public financing will permit and the growth of the city has sufficiently indicated a reasonable permanence in the character of the streets to be lighted. The very rapid growth of Western cities and the consequent change in the streets necessitate, however, a careful study of the lighting system to be adopted to avoid the selection of a type of post that will soon become obsolescent.

Modifications of this general plan are quite practicable, in the opinion of the writer, and in these days of general automobile transportation most towns and cities could afford, on the ground of the favorable publicity gained, to pay all or a material portion of the expense of installing ornamental lighting systems on their principal streets and highways.

UNIFORMITY OF DESIGN

This question of uniformity in design and material in Los Angeles is affected by the general policy heretofore followed by the city to permit posts of any material, such as cast iron, pressed steel or concrete, on any street, provided that the design submitted meets with the approval of the Municipal Art Commission.

It is not the intent of the Art Commission to permit an unlimited number of designs to be used, because the initial cost of such installations and the consequent increased expense of carrying a larger stock to replace broken posts would be undesirable. It is believed, however, that a reasonable variety in design and material may afford harmonious contrasts on intersecting or adjacent streets and provide an opportunity for healthy competition and greater commercial activity in this branch of the business. These advantages seem to justify the additional expense as compared with a policy requiring all ornamental posts to be of the same material and of the same design for each class of street in the city.

CONCLUSIONS AND RECOMMENDATIONS

The experience of almost twenty years of ornamental lighting in this city appears to dictate the following conclusions and recommendations in the installation and maintenance of these systems:

The economy to be obtained in using posts limited to one material and one design for each class of street lighted is outweighed by the advantages of greater commercial activity in this branch of the business permitted by an approval of a limited number of designs of any material for each class of street. All designs should have the same general height to lamp center and be of the same light intensity for the same character of street.

The engineering design of such systems on business and traffic thoroughfares should permit increasing the illumination to meet the changing character of these streets.

The city should assume a portion of the cost, and in many cases the entire cost, of installing and maintaining such systems on well-defined highways entering and leaving the city, on the general ground that advertising of this nature will always pay dividends.

Intensities of illumination on the various types of streets should not be so extravagant as to preclude the ultimate assumption of the entire maintenance cost by the city from the general lighting fund when ordinary overhead lighting has been placed on all streets requiring such lighting.

Existing state laws in California provide an adequate method of securing by direct assessment the installation of these systems. Present legislation for assessing the yearly cost of maintaining these systems in incorporated cities should be so amended as to permit the assessment to be collected at the same time as ordinary taxes and on the same tax bill. The present procedure is unnecessarily expensive, and with two hundred or more separate proceedings required yearly or even every two years, as now permitted by legislation, it places a serious burden on the city departments affected. Amendments will be submitted at the next session of the California Legislature to simplify the present procedure.

While the advertising value of ornamental lighting on any given street or district is unquestioned, no such street should be permitted to adopt standards of illumination either in intensity or design which would prevent a well-balanced and harmonious lighting scheme for the entire city. Street lighting has many angles and it is a co-operative and often a local problem to secure the best results over a period of time.

Electricity in a Modern Lumber Project

IV—Interior Illumination

Night Operation and Peculiarities of Sawmill Work Require High-Intensity General Illumination—Details of the Lighting Installations Employed in the Long-Bell Plant at Longview, Wash.

By FRANK R. INNES
Sessions Engineering Company, Chicago, Ill.

THE lighting of sawmills offers a wide and practically untouched field for the illuminating engineer. The lighting requirements differ quite materially from those in the usual factory where the work is brought up close to the operator. The mandensity in the production areas in sawmill work is low and, superficially, it appears that light is necessary only at the actual operating points. Sawmill design of the usual type includes low head room, marked differences in the levels of working planes and the placing of equipment and machinery apparently with the single idea of interfering with light distribution to the greatest possible extent. These considerations have made it appear to sawmill operators that local lighting is the only practicable illumination scheme, and, as the result of this conviction, most sawmills are fine examples of what artificial lighting ought not to be. However, with the necessity for increasing the output of already installed equipment imposed by present-day economic conditions and the consequent extension of production into the hours of darkness, there is a growing appreciation of the value of scientifically designed illumination.

Requirements of Sawmill Lighting

As before intimated, the lighting requirements of a sawmill are considered to be peculiar to the industry. The head rig cuts up logs varying in length from 16 ft. to 60 ft., and the sawyer must be able to tell almost at a glance how best to cut each log to get the most salable lumber out of it. The log must be well enough lighted to show its size, shape and condition. The trimmer man, handling a battery of twelve to thirty circular saws and operating their controls quite like a player does the stops of a pipe organ, must see clearly each cant or board as the chains bring it up to the saws. He must spot in detail the knots, sap patches and other defects in time to set the stops of his instrument to cut them out. The trimmer man needs good light for his work. Another important person is the grader, who stands beside a set of chains and marks each piece of lumber with a cabalistic device indicating its quality as it goes past him. But before he inscribes the symbols which mean "B" or better, "No. 1 common," or any of the other grades, he must get, in one sweep of his eye, all the information the wood presents to his reading. The usual method of taking care of these and other similar lighting problems in a sawmill has been to install long troughs, plentifully studded with lamps, wherever exigency called for them. The rest of the mill was usually left to a darkness only slightly mitigated by sparsely scattered bare lamps on drop cords. The general effect of this kind of lighting was naturally very bad. The men with the most important and exacting work were continually subjected to very severe eye strains caused by the differences in lighting intensities.

The lighting demands of a sawmill may be divided into three general classes. In the first class are the sawing floors, the areas where the actual production work is carried on, requiring a fairly high lighting intensity. The second class includes the handling and storage areas where discrimination of detail is not essential and the intensity may be reduced. The third class is composed of the machinery floors, which require light for maintenance only.

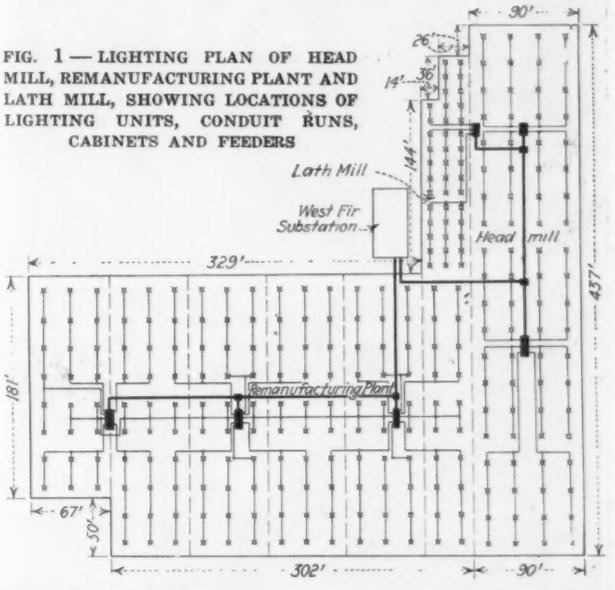
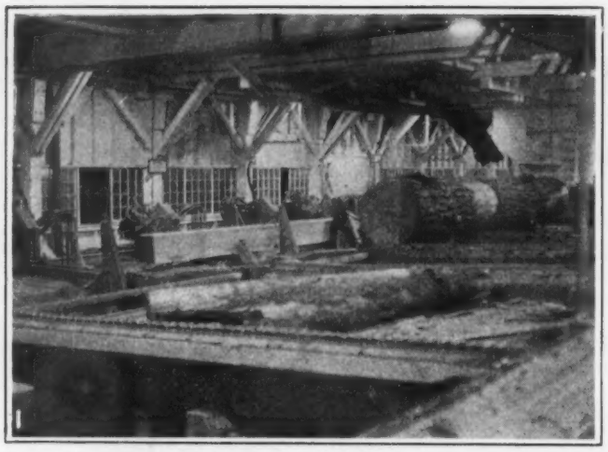


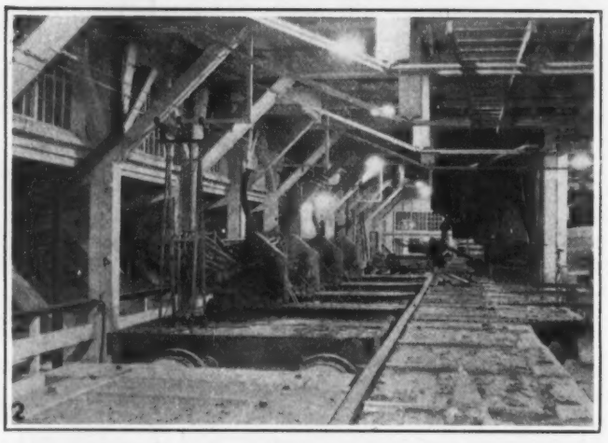
FIG. 1 — LIGHTING PLAN OF HEAD MILL, REMANUFACTURING PLANT AND LATH MILL, SHOWING LOCATIONS OF LIGHTING UNITS, CONDUIT RUNS, CABINETS AND FEEDERS

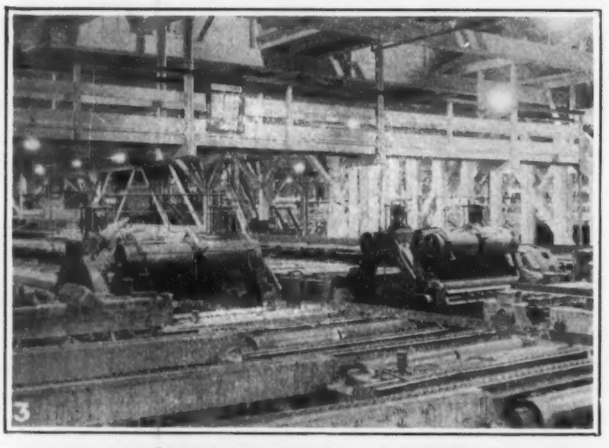
Illumination of Long-Bell Mills

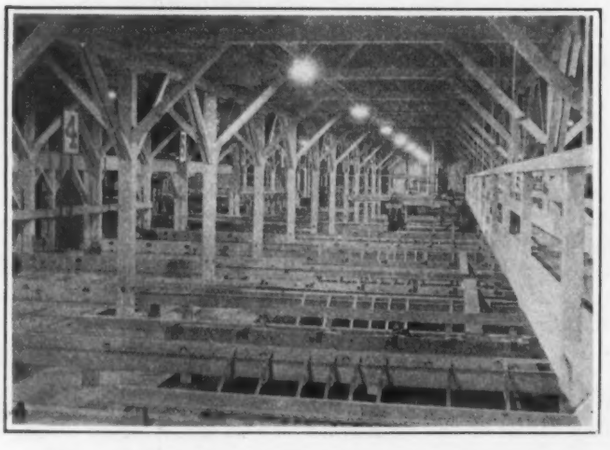
In the illumination design for the Long-Bell mills at Longview, Wash., it was determined to get away from the idea of local lighting as far as possible by installing a system of general illumination so effective that local lighting would be unnecessary. This result was attained to a very satisfying degree. For production areas, the first class mentioned above, the intensity was set at from 5 foot-candles to 10 foot-candles; for the second class, handling and storage areas, 2 foot-candles to 5 foot-candles, and for the third class, which includes machinery floors, no mean was set, since the location of lighting units would be determined entirely by the position of the machinery installed.

Six locations are lighted according to the demands of the first class. These are the sawing floors and filing rooms of the head mill and remanufacturing plant,









the sawing floor of the lath mill and the live areas of the planing mill.

The head and lath mills and the remanufacturing plant are comprised in a single structure, as shown in Fig. 1. This building has two stories, the operating areas being on the second floor. The filing rooms for the head mill and the remanufacturing plant are in the monitors of the respective sections of the building. The sawing floors of the head mill and lath mill are clear of columns, the monitor roof being supported on trusses resting on the side-wall posts. The remanufacturing section of the building is divided into six north and south bays, as shown on the drawing, with necessary columns on the lines between them. A monitor about 40 ft. wide runs east and west across the six bays.

HEAD-MILL LIGHTING

The head-mill sawing floor is 90 ft. wide and 437 ft. long, with head rooms below the bottom chords of the roof trusses of 17, 18 and 19 ft. at different floor levels. The rolls and transfers on which the lumber moves are horizontal, 30 in. up from the highest floor level. This fixes the working plane at 14½ ft. below the chords. The least number of "RLM" units to furnish uniform distribution of light over an area 90 ft. wide and with a ceiling height of 17 ft. is four. Owing to the positions of the machinery and equipment, it was practicable to fix the spacing at 22 ft. between lamps. The walls, trusses and the inside of the roof are painted with a white fire-resistant paint which is a good reflector of light.

LIGHTING INSTALLATION IN SORTING, STORAGE AND LOADING SHEDS

Buildings	Area Sq.Ft.	Number of Units	Size of Units in Watts	Average Calculated Intensity in Foot-Candles	Average Observed Intensity in Foot-Candles
Two dry sorters	178,500	60	1,000	3.0	4.0
Three rough lumber sheds	233,700	48	1,000	2.0	2.5
Four loading sheds	185,640	48	1,000	2.5	3.0

CALCULATING INTENSITY

The calculation for an approximate intensity of 10 foot-candles, using bowl-enameled lamps in "RLM" reflectors, is as follows:

Area = 90 ft. × 437½ = 39,285 sq.ft.
Depreciation factor = 1.25.
Utilization factor = 0.64.
Number of lamps = 80.
Lumen requirement per lamp = (39,285 × 1.25 × 10) ÷ (0.64 × 80) = 9,590.
Initial lumen capacity of 500-watt bowl-enameled lamp = 8,740.
Intensity per lamp area = (8,740 × 0.64) ÷ (484 × 1.25) = 9.5 foot-candles.

The average intensity observed in the head mill with a Keuffel & Esser light meter soon after the installation was completed was 12 foot-candles. Since this was before the depreciation factor became effective, it checks the calculated value quite closely. Three of the accompanying night photographs show the illumination in the head mill.

TYPICAL INTERIOR MILL LIGHTING

No. 1. West log deck in head mill under 12 foot-candles.
No. 2. West head saw and log carriage in head mill.
No. 3. Main edgers in head mill; average intensity, 12 foot-candles.
No. 4. Discharge belts from planing machines in planer mill; an average of 8 foot-candles was provided in all working areas.

The installation in the remanufacturing plant was simply an extension of the method and calculation employed in the head mill. The six crosswise bays, five of them 65 ft. wide and the sixth 42 ft., lent themselves readily to the 22-ft. spacing. The calculated average intensity for this area was 9.4 foot-candles, and this was checked by the initial observations, which averaged 11.5 foot-candles with high and low values of 13 and 10.

LIGHTING FILING ROOMS

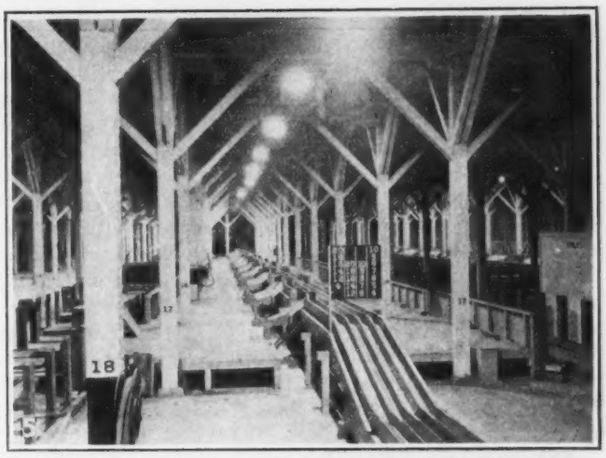
The saw-filing rooms of the head mill and remanufacturing plant are two locations where the virtue of general over local lighting was demonstrated beyond any doubt. Before designing the illumination scheme for these areas the writer sought and received much advice concerning the special requirements of lighting demanded by saw filers. The filer is the king of the mill; on him depends successful operation, for if the saws are not kept in perfect condition, production will be greatly retarded and the quality of the output will suffer. Therefore, if the filer wants anything in his domain, he gets it without question.

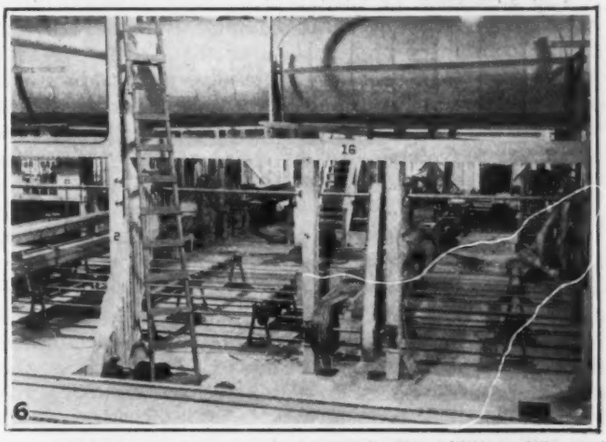
The filers were not yet on the job when the lighting scheme came up for consideration, and the engineer could not learn their desires in the matter. In desperation over the contradictory advice offered, a decision was made to install a good, high general illumination scheme and see what the filers said about it when they arrived. The head-mill filing room is 90 ft. x 72 ft. with 14-ft. head room. In this were installed twenty 500-watt bowl-enameled lamps in "RLM" reflectors at 18-ft. spacing, producing an average intensity of 16 foot-candles. The remanufacturing plant filing room is 40 ft. x 63 ft. with 14-ft. head room. Six 500-watt bowl-enameled lamps in "RLM" reflectors at 19½-ft. spacings were installed, producing an average intensity of 10.7 foot-candles.

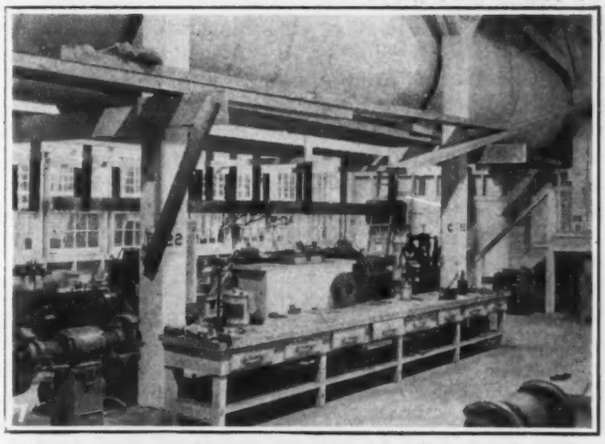
When the filers arrived they were very much pleased and said that the only reason saw filers had gained the reputation of being cranky about lights was because proper illumination had never before been provided. Two additional 500-watt units have been installed in the remanufacturing plant filing room on account of the shadows produced by a saw storage rack which was built after the room was in use. Other than this no change has been made in the lighting of either room, and it is of particular interest to know that there has been no request for local lighting at any point.

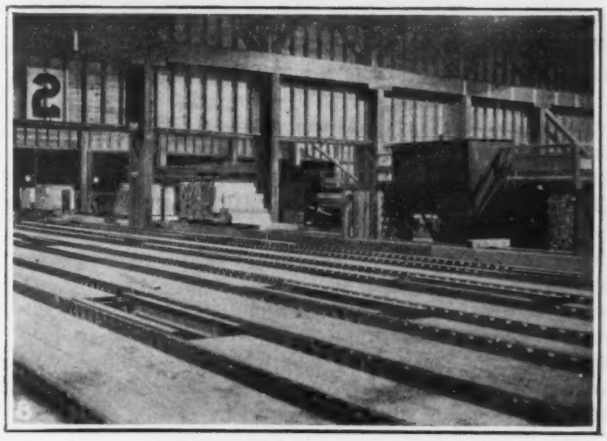
LATH MILL AND PLANING MILL

The lath mill, also shown in Fig. 1, required treatment different from the other two sawing floors. The roof is low, the clearance between trusses and floor being about 10 ft. Lamps of 150-watt size in "RLM" reflectors at 12-ft. spacing were used. The work in this mill is almost entirely mechanical. No close perception of grade or size of material is necessary, and for this reason a lower light intensity than on the other two sawing floors is allowable. The average intensity









NIGHT VIEWS OF INTERIORS

No. 5. Bundle drop sorter in planer mill between two monorails.

No. 6. "Take-off" belts from planing machines in planer mill. Note the large pipe, introducing complications in illumination design.

No. 7. Illumination of saw filing and grinding rooms. This presented a serious problem. High-intensity general lighting of about 16 foot-candles was found to be the solution. Notice the interfering suction pipe to contend with.

No. 8. View in the dry-sorting sheds, where an average intensity of 3 foot-candles was provided.

for the lath mill was figured to be 6.5 foot-candles, and this was closely checked by the observed average value of eight.

The structural design of the planing mill imposed conditions on the illumination problem different from those in the other production areas. This building is 597 ft. long and 424 ft. wide and is of saw-tooth roof construction. The tooth sections average 60 ft. wide. As shown in Fig. 2, all of the saw-tooth sections except the southermost one, which is clear, are divided into rectangular bays with one dimension averaging not more than 20 ft. and the other ranging from 20 ft. to 30 ft. The lighting problem is further complicated by the monorail system and the large suction pipes for taking up the shavings from the planing machines, both of these equipments being suspended below the roof trusses.

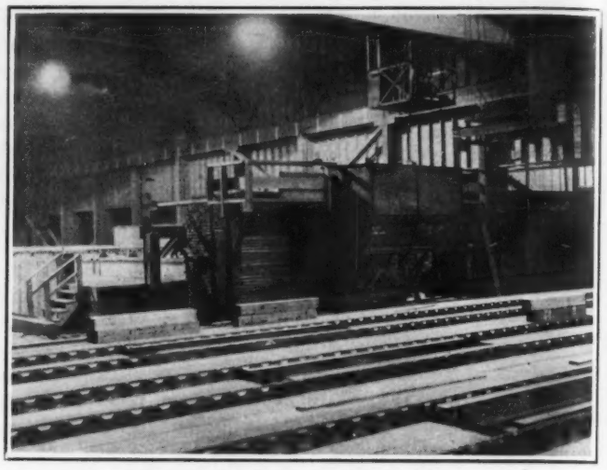
The adjacence of various-sized bays, plus the presence of so much overhead equipment, made uniform lighting intensity impossible over the whole floor area except at prohibitive cost. These adverse considerations are somewhat compensated for by the generous use of white paint and the ample headroom, which averages about 23 ft. from the bottom chord of the roof trusses to the floor.

The drawing in Fig. 2 shows that the illumination scheme is not an affair of general calculation, but is an adaptation to circumstances arrived at by a considerable number of independent calculations. A successful attempt was made to keep the light intensity above 5 foot-candles in all working areas. Angle reflectors to direct light below the suction pipes and along the monorail lines and "Parabolite" reflectors above the long car-loading platform were used. Above the grading tables, where the finished lumber in the form of flooring, siding, molding, etc., is sorted according to a strict regard for quality, the lighting intensity was practically doubled by the installation of lights in every bay instead of in every other one, as is the general case. The observed intensities averaged 8 foot-candles in all of the working areas except the grading places, where they were about 14 foot-candles. Three of the accompanying views show the well-lighted areas in this section of the mill.

SORTING, STORAGE AND LOADING AREAS

From the standpoint of design a much more satisfactory installation was possible in the dry-sorting, storage and loading sheds. These are nine in all, averaging 80 ft. wide and ranging from 600 ft. to 1,200 ft. in length. There are no columns in these sheds, and the heights from floor to bottom chords of roof trusses vary from 35 ft. to 40 ft. The uniform bent intervals of 18 ft. permitted the location of lamps on the trusses at 54-ft. spacings. In order to effect an even distribution of light, the units were staggered 10 ft. off the building center lines. At the centers of the dry-sorting sheds, where grading operations are carried on, the light intensity was increased by closer lamp spacing. Clear lamps of 1,000 watts in "RLM" reflectors were used throughout. The table shows the installation in these buildings, and two of the illustrations show the lighting.

Extending west from the remanufacturing plant are two open-sided structures 30 ft. wide and 618 ft. long. These are the "green sorters," where the lumber going out into the yard for air drying is sorted according to length and grade and pulled off the chains into piles



LUMBER "UN-STACKER" IN DRY-SORTING SHEDS

to be picked up by the monorails. The bents are spaced 20 ft. apart in these structures, and the bottom of the roof trusses is only about 7 ft. above the top of the lumber carrying chain. To light these areas evenly and to the intensity required for the work would have required an excessive number of units if the problem had been attacked in the ordinary way. It was decided to install 500-watt lamps in "Parabolite" reflectors in the peak of the roof above the trusses at 40-ft. spacings, at alternate bay centers. It was calculated that the truss shadows from any one lamp would not be sharp on account of the incidence of the light rays and that they would be neutralized by direct rays from adjacent lamps. This was found to be the case when the installation was completed. The white paint on the inside of the roof and on the trusses with its high reflection value, plus the interplay of direct light from

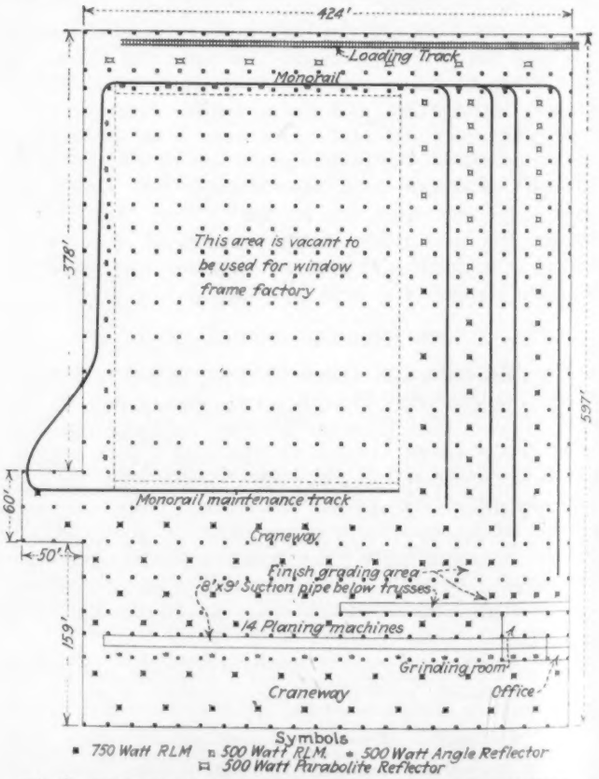


FIG. 2—POST PLAN OF PLANING MILL, SHOWING LOCATION, TYPES AND SIZES OF LIGHTING UNITS

adjacent units, resulted in a strikingly even and pleasing illumination of about 5 foot-candles along the entire length of the two buildings. The success of these two installations led to the adoption of "Parabolite" reflectors installed above trusses in all long and narrow areas such as lumber transfers and conveyors.

Maintenance Areas

The third class of lighting requirement was almost entirely outside the bounds of illumination calculation and design. It includes the first floors of the building which houses the head mill and remanufacturing plant as well as other locations about the mill. The areas here concerned are broken up into various-sized and irregularly shaped bays which defy any attempt to obtain uniform lighting within reasonable cost. They contain the drives for the production machinery, an intricate system of conveyors for disposing of the wood refuse from the saws, and the returns of the handling chains. Since these locations are maintenance areas exclusively, requiring light only for the care and oiling of machinery, the general illumination scheme was limited to insuring that no important or dangerous places should be unlighted. The location of lamps to illuminate active equipment best, with the installation of a generous number of plug receptacles for portable lamps, was the plan used.

The lighting circuits in the mills are all 220-110-volt, three wire. "Mogul" and medium socket units are kept on separate circuits. With the exception of several long circuits in the dry-sorting sheds, which are of No. 8 wire, all "Mogul" circuits are of No. 10. The medium-socket circuits are of No. 12 wire, as are also the plug receptacle circuits. The entire lighting system is in conduit. All neutral wires are covered with a white outer braid and are connected without fuse or switch break to the grounded neutral buses in the panels.

Cleaning and Maintenance

On account of the rapid movement of material on the sawing floors of the head mill and remanufacturing plant and in the planing mill some means had to be devised so that the lighting units would be accessible for cleaning and maintenance without interfering with activity in the production areas. After some study it was decided to lay continuous plank bridgings along the lines of lighting units and normal to the lines of the trusses. The conduit was run along the sides of these bridges, and the lighting units were suspended by means of a clevis from a "TMD" condulet. The leads to the lamps were brought out from the condulet in a short piece of flexible conduit. With this suspension it is possible for the maintenance man to stand or sit on the plank bridge, swing the lighting unit up through an arc of 180 deg. and perform his required work without interrupting or interfering in any way with the work on the production floor. This suspension is used also in the sheds, where the lamps are hung very high. All of these sheds are equipped with cranes. The maintenance man rides on a crane to a lamp, climbs up onto the beam and does the necessary work on the unit while the crane goes about its business. When the work is done the maintenance man signals the crane operator to carry him to another lamp. In this way lamp maintenance may be attended to during the working day and requires no overtime.

The outside lighting is not yet completely installed, and it can be better described at another time. The complete electrical engineering installation for this large mill was made by the Sessions Engineering Company of Chicago.

Letters from Our Readers

The Mercury-Arc Rectifier

To the Editor of the ELECTRICAL WORLD:

In an editorial printed in your November 22 issue and subsequent discussions in this column on December 13, the subject of the mercury-arc power rectifier under short circuit has been dealt with. It seems to me that the statement "The rectifier is the first equipment to go out in case of a short circuit" does not accurately describe what is happening to the rectifier under short-circuit conditions, and that therefore some remarks on this subject by one who has had several years' field experience with Brown-Boveri rectifiers would be appreciated by your readers.

The mercury-arc rectifier may "go out" for the following reasons:

1. Through opening of the circuit breakers on the alternating-current or direct-current side under overload.
2. Through the main arc becoming extinguished.

The latter may happen if, following the rupturing of a short circuit, the load drops to zero, or if there is a heavy dip in the supply pressure which may be caused by a short circuit in the primary system. The going out of the main arc under these conditions can be prevented with absolute certainty if an auxiliary arc is kept burning, the energy consumption of which is negligible. This excitation device, as it is called, is incorporated in each rectifier.

The difference in the performance of the mercury-arc rectifier and of a rotary converter in case of a short circuit on the alternating-current side is fundamental. The rotary converter feeds back on the short circuit, and this has been responsible for serious flashovers in many instances. The rectifier simply ceases to supply current until the supply pressure is restored.

The performance of a rectifier under short circuit on the direct-current side is in principle not different from that of a static transformer. The limiting factor in either case is the temperature attained by the current-carrying parts, which requires that both transformer and rectifier must be disconnected by automatic circuit breakers before the maximum permissible temperatures are exceeded.

Since the heat that is produced in a rectifier is proportionate to the current and not to the square of the current as in other electrical machines, the relation between the load in amperes and the time during which this load may be carried without producing excessive temperatures follows the law of a hyperbola, provided the cooling through heat radiation or heat convection is not taken into account. It follows, therefore, and this is confirmed by experience in plant and on test bed, that there is no limit to the peak value of the current, but only to the time of its duration. In other words, the rectifier has no such limiting features as the rotary converter has in its commutator, nor is it necessary to protect it by extra-high-speed circuit breakers. The setting of the rectifier circuit breakers can therefore be

high, and sufficient time lag can be given to them to allow the feeder breakers to clear a short circuit.

If these factors are fully taken into consideration when the plant is laid out, the rectifier will not be the first to go out in case of a short circuit or severe overload.

In plants where there is only one or a limited number of feeders often no selectivity is provided between rectifier and feeder breakers. It is immaterial here if in case of a heavy short circuit near the substation both the rectifier and the feeder breakers open at the same time, since the extent and duration of the interruption of service will not be greater than if only the feeder breaker had opened. The rectifier can be put back on the line exactly like a transformer simply by reclosing the alternating-current and direct-current breakers. This operation may be performed by the attendant or automatically, and it need not take more than a few seconds.

The short-circuit current of a rectifier is limited by the impedance of the transformers and is therefore not much in excess of the short-circuit current of other converting apparatus.

O. NAEF.
New York, N. Y.

Good Lighting a Necessity, Not a Luxury

To the Editor of the ELECTRICAL WORLD:

That it is the man in the electrical industry who must be "sold on" more and better lighting was indicated again by a display at the Iowa State Fair, illustrated and favorably commented upon in the ELECTRICAL WORLD for November 8, 1924 (page 1010), under the heading "Cost of Electricity and Luxuries Compared." This display showed the average family's yearly expenditure for luxuries and for electricity as follows: "Tobacco, $95; gasoline, $68; ice cream, $50; candy, $48; electricity, $25." The ELECTRICAL WORLD said: "In dealing with complaints of the cost of electricity it is a good plan to show the customer a comparison of the yearly expenditures for electricity and those for luxuries. It is often very effective to point out that even with a liberal use of electricity its cost is lower than that of any items on the luxury list."

I doubt very much if $25 will cover the average cost of electricity for the same families who pay for luxuries the amounts above stated. I also doubt whether a complaint over a high bill would be well met by such a response as: "What are you kicking about? The average household use of electricity is $25 a year—how could this bill be wrong?" But, as regards myself and my average neighbors, wouldn't we have a real "kick coming" with the knowledge that the average expenditure was $25, particularly as expenditures for luxuries put us in the average class?

Lighting men have for years been trying to sell more and better service, and here we have the electrical engineering department of Iowa State College marking a consumer as extravagant, or at least above the average, if he uses more than $25 worth of electricity a year, and the ELECTRICAL WORLD advising that a comparison of this kind be permanently displayed in every utility office!

My use of electricity for lighting a small home is $75 to $100 per year. Am I being robbed through high rates or a fast meter? I know I am not extravagant. My individual consolation, however, comes from coupling my lighting costs up with other necessities—for light would be a necessity at a price away beyond what it is now costing us. Gas for cooking and heating water is $150, coal for heating for six months $200, milk and cream $250, meat $250—even our ice man and the telephone company get nearly as much as I pay for lighting service, and there is no comparison between the relative value of the services. Of course, we use a 150-watt lamp in the kitchen, but that is not an extravagance. A dark kitchen would mean a dissatisfied maid who could otherwise be satisfied with $10 more in wages—or, as they are now getting it, in salary—per month, so the satisfied maid pays for the 150-watt lamp. The extra cost for a 15-watt lamp in the lower hall from retiring time to 6.30 a.m. is split between saved premiums for burglar insurance and doctors' fees, owing to the lessened liability of any one falling down stairs or bumping into door casings or furniture in the dark.

This hall light can be run for nearly two years from midnight to 7 a.m. for the fee charged by the doctor for one visit, admitting that you would otherwise suffer neither inconvenience nor damage—and a serious accident would be good for more than one doctor's call.

Probably ten years or more ago electric light was a luxury. More attention was given then to good gas lighting. Today electric light is a necessity, and as such it is suffering from cheapness. The electrical man seems to feel that he has done all that was asked of him when he uses or has persuaded some one else to use the ideal of "three times the light for the same money."

We need a new slogan, as in my experience the hardest "prospect" for more or better lighting is the electrical man—whether he is in the lamp factory, the fixture showroom, the central station, the industrial plant, the department store, the electric shop or the editorial chair. How can we hope to "sell" the ultimate user if the "man in between" has not fully "sold" himself?

The successful lighting salesman is not selling lamps, lumens, luminaires or kilowatt-hours, but the service to the user that effective lighting equipment makes possible in the form of home decoration, prevention of accidents, increased production or more rapid sales turnover. Good lighting need not be cheap and it is not a luxury.

NORMAN MACBETH.
Macbeth Daylighting Company,
New York, N. Y.

Radio and the Heat Pad

To the Editor of the ELECTRICAL WORLD:

We note in your issue of January 24 an article by T. C. Russell entitled "Radio Versus Heat-Pad Thermostats." We have had several cases of radio interference which have finally been traced to thermostatically controlled heating pads. In each case, however, it was found that the thermostats, instead of having a positive action, opened and closed so rapidly that a vibrating effect was created, which gave a frequency as high as 40 cycles, and this caused a disturbance so pronounced that radio reception was impossible not only in the same house but within a radius of approximately one-quarter of a mile.

It would seem to us that the answer to the heat-pad question is, not to do without thermostats, but to use a type of thermostat which is positive in its action.

W. A. UPHAM,
Division Superintendent.
New Jersey Power & Light Company,
Dover, N. J.

Central Station and Industrial Practice

Interlocking Disconnecting Switches

PROTECTION against wrong sequence of switching on the double-bus system of the Consumers Power Company's Garfield Avenue outdoor substation at Flint, Mich., is provided by a complete electrical interlocking of the twenty-four 140,000-volt motor-operated inter-connected disconnecting switches. These

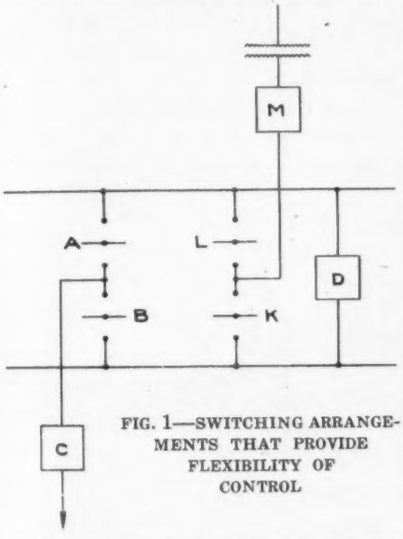


FIG. 1—SWITCHING ARRANGEMENTS THAT PROVIDE FLEXIBILITY OF CONTROL

switches were designed and made by the Railway & Industrial Engineering Company. The station was designed with a 140-kv. double-bus system because it is one of the principal switching centers of the system as well as the chief source of power for Flint and vicinity. Therefore it was desired to be able to isolate and test out any faulty line without interfering with other equipment and in general to be able to separate the system into two sections at will. This flexibility was wanted without the use of two oil breakers per circuit on account of the cost of such equipment; on the other hand, it was deemed unwise to sacrifice complete and individual automatic protection, which meant that the line breaker should not be bypassed with a disconnecting switch in order to connect the line to the other bus. It was also desired to maintain complete control of this throw-over connection on the station switchboard, to facilitate rapid switching operations during trouble on the system.

For these reasons mainly it was decided to equip each circuit with one main oil circuit breaker and two electrically operated air-break switches—the former for opening and closing the circuit, and the latter for connecting the circuit to the desired station bus. In addition, the air-break switches were arranged so that both could be opened at the same time, provided the oil breaker was previously opened, and thus they serve as bus disconnecting switches for the oil switch and the line as well.

The control scheme as laid out for this equipment provides enough electrical interlocks to prevent faulty operation of any device. This method of control is explained by reference to Fig. 1. This diagram shows one bank of transformers and one circuit, with *A*, *B*, *K* and *L* representing the 140-000-volt, three-pole electrically operated disconnecting switches. Remote-control oil circuit breakers are shown in *C*, *D* and *M*. Normally, either switch *A* or switch *B* is closed before connecting the oil switch *C* to the bus. Provision is made for the synchronizing of the two buses across the tie breaker *D*. Supposing that the switch *A* is then closed with switch *D* closed, it is possible to close the second disconnecting switch. But when the second switch *B* is fully closed the first, *A*, opens automatically. This is accomplished by one operation of the control switch and is continuous and self-sustaining. Once the control switch is moved, the operation is completed independently of any action the operator may start. Furthermore, the transfer is only possible when the tie breaker across the two buses is closed. This interlock prevents throwing the two buses together when they might be out of synchronism. In order to disconnect the circuit completely, the oil switch *C* must be opened before the disconnecting switches are opened. In other words, *A* or *B* cannot both be opened unless *C* is open.

For the transformer circuits the same automatic interlocking features as with switches *K*, *L* and *D* permit the uninterrupted transfer of load from one bus to the other. If switch *K* is closed, then switch *D* must be closed before the switch *L* can be closed. After switch *L* is closed switch *K* will open automatically. Switch *K* or *L* cannot be opened unless switch *M* is opened except in the case of the automatic transfer operation. One control switch of the rotary type is used for each disconnecting switch. Indicating lamps, in addition to the ordinary red and green lamps for the oil circuit breaker, show the operator whether the switches are open or closed, and if closed to which circuit the bus is

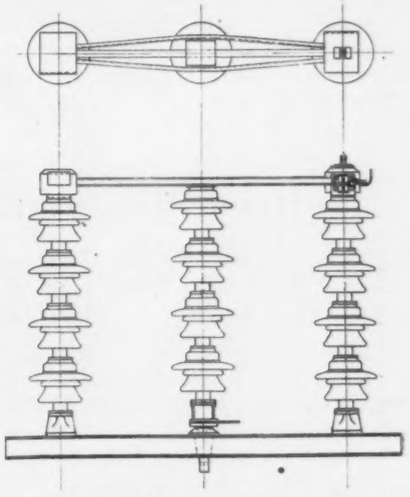


FIG. 2—INTERLOCKING DISCONNECTING CONTROL SWITCH OPERATES ON THE DOUBLE-BREAK-PER-POLE PRINCIPLE

connected. The switch itself is shown in Fig. 2. It is of the double-break-per-pole horizontal opening type with the center column of insulators rotating on a ball thrust bearing which carries the switch blade. This blade consists of a section of hard-drawn copper bar mechanically reinforced by light trussed channel iron. William W. Tefft is the chief engineer of the Consumers' Power Company.

Floodlighting Boiler Tops

BY F. SHANKS
Electrical Plant Superintendent Indianapolis Light & Heat Company, Indianapolis

ILLUMINATION of boiler tops and ash pits by means of floodlights solved the expensive maintenance problem of replacing corroded conduits and burned-out lamps at the Mill Street station of the Indianapolis Light & Heat Company. The use of floodlamps mounted on opposite upper walls of the boiler room

thus eliminated the construction difficulties in properly suspending long lengths of conduits over boiler tops. By placing the control switches at the boiler-room floor level directly below the mounted floodlights operators are assured of good illumination before being required to climb around boiler tops. With two 400-watt lamps providing effective illumination on boiler tops, which even at best are hot, dirty places, operators are able to perform their work more efficiently and with less danger of accident.

The same system of floodlighting boiler ash pits for this station has been installed, following experience with high maintenance cost and grounding troubles in the case of conduits running beneath the ash hoppers. Four Western Electric floodlighting units are installed in the two ash pits. Two units face each other through the length of the ash pit so that shadows are kept down to a minimum. These floodlamps were first installed in 1922 and have materially reduced the maintenance expense of continually replacing corroded conduits in an atmosphere of steam and hot gases. The use of floodlighting fixtures has also eliminated the troubles arising from grounds in conduits which were due to ruined insulation. Here, as in the case of floodlighting boiler tops, the control switches are placed close to the unit so that installation expense is kept at a minimum.

The money saved in replacing lamps and corroded conduits on the old system has more than paid for the installation of the new floodlighting units. The increased illumination has been of great value in times both of normal and of emergency operating conditions.

Recording System Disturbances

Device for This Service Developed by New York Edison Company Has Been in Satisfactory Use for More than Eight Months

BY A. F. HAMDI
General Foreman Test Department, New York Edison Company

TO ANALYZE correctly system disturbances and to be able to provide suitable protection in the form of relays, it is of great importance in certain instances to have correct records of the duration and the extent of pressure depressions.

In general, on circuits properly protected by relays a faulty section may be completely disconnected from the rest of the system in from one-half second to probably two or three

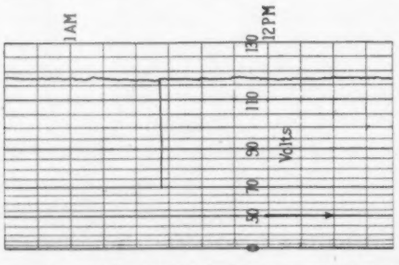


FIG. 1—TOTAL VOLTAGE DROP DETERMINED FROM THIS CHART

seconds. It is, therefore, evident that a recording voltmeter of the usual type will not correctly give either the extent or the duration of such a pressure drop. The first function is not accomplished because the moving elements of instruments of standard make have a certain amount of inertia which prevents their reaching a correct indication in probably less than half a second. In some cases this time is much longer. The second function is not accomplished because the usual chart speeds are entirely too slow for work involving fractions of one second.

There are on the market instruments with chart speeds as high as 12 in. per minute, but such high chart speeds cannot be used for continuous service. It means, therefore, that some form of undervoltage relay must be used in connection with such a device to start the high-speed chart at the time of the disturbance. The objection to such a scheme is that the chart takes some time to come to full speed so that disturbances of very short duration cannot be correctly timed. Furthermore, small pressure fluctuations cannot be recorded, as the undervoltage relay must be set to operate at a definite pressure, probably from 10 per cent to 15 per cent below normal.

With the above points in mind, the writer has developed in the test department of the New York Edison Company the device described in this article. It has been in service on one of the company's circuits for eight months.

A front view of the recorder is shown in Fig. 3. On the left is a standard-make recording voltmeter. To the pen arm of this instrument we have added short extensions to which was attached, with standard jewels, a long pointer reaching all the way out to the round chart seen on the right. This is a smoked chart driven by a direct-current motor at the rate of 2.5 r.p.m. In this manner each "hour" division, such as is found on the usual type of twenty-four-hour round chart, represents one second. Consequently intervals of time as short as 0.1 second can be read on the chart. In this connection it may be added that we have had a special chart made (see Fig. 4) where the major time divisions are subdivided into five equal parts, all time divisions being straight radial lines.

Under normal conditions correct

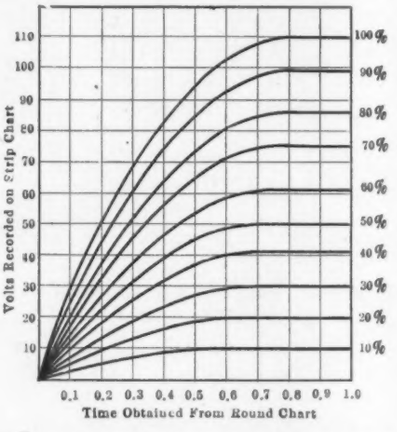


FIG. 2—CALIBRATION FOR PRESSURE-DROP DEPRESSION RECORDER

pressure is recorded on the strip chart of the voltmeter and the extension pen draws a circle near the inner edge of the smoke band. As soon as a disturbance occurs the pressure drops and the extension pen is pulled away from the inner edge of the smoke band, the distance away from the inner edge depending upon the actual pressure drop and the duration of the disturbance. A record obtained with this device is shown in Fig. 4. The smoked charts are removed immediately after each disturbance. As long as no disturbance occurs there is no need for changing the smoked chart.

The time of the disturbance is read from the radial lines, namely, from the beginning of the jump outward to the beginning of the return trip to the central normal pressure circle. The actual pressure drops are obtained from comparing the radial pen travel with standard curves plotted for various voltage

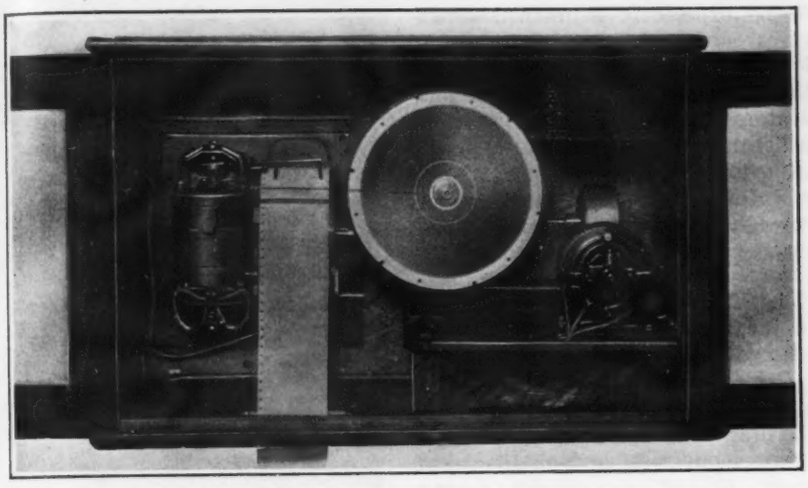


FIG. 3—INSTRUMENT FOR RECORDING VOLTAGE DISTURBANCES ON NEW YORK EDISON SYSTEM

drops of different duration (Fig. 2). This procedure becomes necessary because the moving element of the voltmeter has considerable time lag —amounting to about one second for its full travel. The motor driving the round smoked chart runs continuously, hence there is no time lag from that source.

The method of interpreting results obtained with the above device is as follows:

1. From the round chart (Fig. 4) obtain the duration of the disturbances. In Fig. 4 that time is 0.6 second.

From the strip chart (Fig. 1) obtain the apparent extent of the pressure drop. In Fig. 1 this drop is 47 volts.

3. Plotting the above two values on the calibration curves shown in Fig. 2, we find that a recorded pressure depression of 47 volts lasting 0.6 second represents a true pressure depression of about 48 per cent.

4. Forty-eight per cent of 117 volts (normal pressure immediately before the disturbance as obtained from Fig. 1) is approximately 56 volts. Accordingly, the lowest pressure during the disturbance recorded in Figs. 4 and 1 was 61 volts (117 — 56 = 61).

Results obtained with this device are accurate within better than 5 volts, which is sufficient accuracy for the purpose in mind.

In this connection I should like to add that I have read with interest the article by George S. Diehl in the June 7, 1924, issue of the ELECTRICAL WORLD describing a device designed to serve about the same purpose as the device described above. It is the author's opinion, however, that Mr. Diehl's equipment is probably subject to some of the drawbacks mentioned earlier in this article. It may be of interest to state that the first thing we looked into was a double-speed instrument which would be thrown to high speed by an under-voltage relay as soon as the disturbance occurred. We had, however, to abandon this scheme, as the recorder used required considerable time to reach full speed when changed from low to high speed during the disturbance.

FIG. 4—SPECIAL CHART USED TO DENOTE OCCURRENCE AND DURATION OF DISTURBANCE

Examining New Meters

ALL NEW meters received by one electric power utility in the Middle West are examined for visible mechanical damage and tested for accuracy. Among the defects most frequently noted in new meters are the dislocation of magnets, bent top bearings, iron filings on the magnets and dirt in the meters due to broken glasses and jammed hands. To remove dirt which may have accumulated in the meters because of injury of the glass over the dial the meters are blown out with an air hose conveniently arranged at each test bench. In addition, they receive the usual test for accuracy by comparing them with the rotating standard.

Progress in High-Voltage Cable Manufacture

PROGRESS in the manufacture of single and multiple conductor, paper-insulated, high-voltage cable has been made chiefly in its mechanical construction, according to a paper by R. A. Paine, Jr., of the Brooklyn Edison Company, which was presented before the recent convention of the Empire State Gas and Electric Association at Syracuse, N. Y. During the past year new equipment has been properly designed, and each manufacturer has worked out his individual problem based on his particular needs.

Extensive research work on the materials, paper and impregnating oil has been carried on in the laboratories of the cable companies, and in this work they have been receiving close co-operation from the manufacturers of cable paper and from the oil refiners.

Very satisfactory results have been obtained on the electrical characteristics of wood-pulp paper, but the material generally does not meet the severe physical requirements necessary to be satisfactory in handling during installation. In like manner different grades of oil are tested and analyzed to determine the type and quality that give the best results in the completed cable.

Where manufacturers have previously used an impregnating compound which at normal room temperature is a solid, heavy substance, they are now changing to a substance which is almost fluid at this temperature. A more complete, thorough saturation is apparently obtained by the use of a lighter compound.

Most manufacturers have eliminated the use of rosin in the compound, primarily to reduce the dielectric power loss and power factor. It has been found that low-loss cable can be made with a rosin content, and that this loss below 80 deg. C. is within safe limits. Above this temperature the power loss increases very rapidly, but as this temperature is far above the maximum permissible operating temperature for high-voltage cable it is not important.

FACTORY INSPECTION AND TEST

Routine factory inspection is being generally carried on during process of manufacture, and careful tests are made to determine the electrical and physical characteristics of the completed cable. This factory inspection during the manufacturing process has been found very essential on high-voltage cable. It is possible in this way to keep a careful check throughout the various phases of manufacture, and faulty construction can be detected before it has progressed too far.

Before saturation samples are cut for physical measurements from lengths which have been cabled. The cable is examined for registrations, wrinkling of conductor insulation and divergence of the sectors. If the sample is unsatisfactory in any one of these essential factors, the cable length is held up. A final check is then made on the physical construction when the completed cable is submitted for final inspection and test.

Very few changes have been made in preparing the cable ends for the routine factory voltage test, as very little trouble has been experienced in this test. Greater care is necessary in preparing the ends for dielectric breakdown test on either hot or cold samples, and further improvement is to be expected. A method which gives fairly good results is as follows: Use a large cone at the end of the cable; carefully spread the conductors apart; pack soft cotton, which has been boiled out in petrolatum to remove all trace of moisture, down into the crotch, and then force down between the conductors small wedge-shaped barriers of mica or other suitable high dielectric material. The ends are then completed in the usual manner by filling the cone with hot petrolatum.

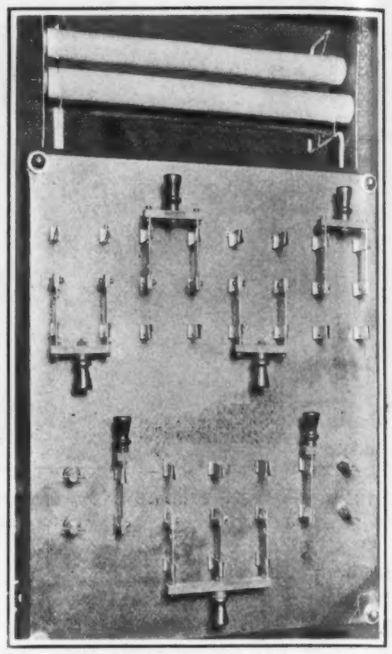
Cable ends prepared in this manner are generally good to withstand a voltage of about 200 kv. between conductors, and on life tests about 135 kv. for about twenty hours, without failure in the crotch.

Approximately 340,000 ft. of three-phase, 350,000-circ.mil sector-conductor cable rated for 33,000-volt operation has been manufactured for the Brooklyn Edison Company during the past year by five cable companies. The rejections at the factories on cable which did not meet the specifications have been for the following causes: Routine factory voltage test failures, insulation resistance, bend test, wrinkles in the paper insulation, light lead, burned paper, registration of tapes, poor saturation, marker unsatisfactory, distorted turned sectors and overheated compound.

Simultaneous Testing of Eighty Meters

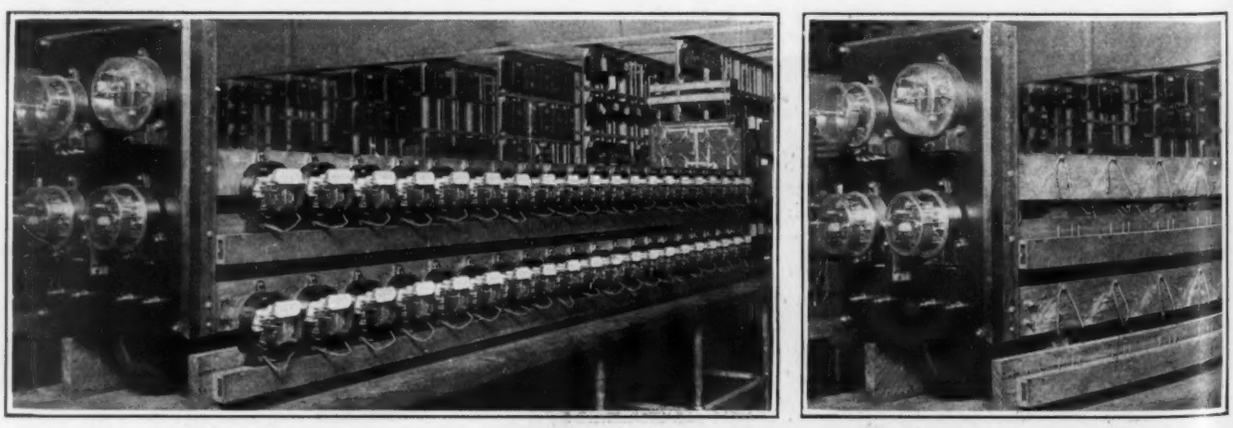
BY J. S. CRUIKSHANK
Superintendent Meters and Installations, Consolidated Gas, Electric Light & Power Company of Baltimore

TO SPEED up the testing of meters before they are installed on customers' premises the Consolidated Gas, Electric Light & Power Company of Baltimore has put into its regular routine of meter testing a method of simultaneous operation of racks of eighty meters checked by standard meters using the principle of concurrent starting and stopping of the entire group at a fixed number of revolutions of the master or test meter as the test-time interval. The meter racks, standard meters and method of connection are shown in the accompanying illustrations.

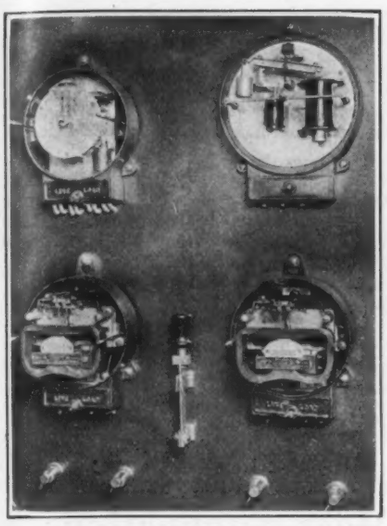


THROW-OVER SWITCH FOR FULL-LOAD OR LIGHT-LOAD TESTS

The common practice of meter testing is to operate either individual meters or banks of meters controlled manually. In this system of group testing the control is semi-automatic by means of a relay counter and an automatic stop through the relay control after the completion of the cycle represented by the number of revolutions of the standard or test meter.



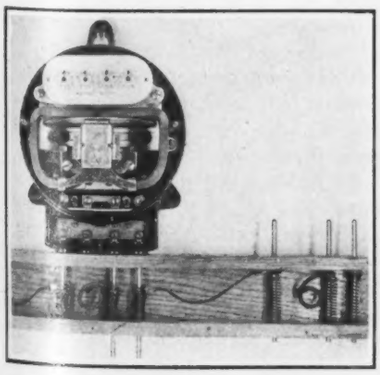
LEFT—RACKS FOR SIMULTANEOUS TESTING OF EIGHTY 5-AMP. METERS. RIGHT—TESTING STARTED BY MEANS OF PUSH-BUTTONS SHOWN AT TOP OF UPPER RACK



CONTROL PANELBOARD FOR METER TESTING

Upper Left—Start of relay counter. Upper Right—Automatic stop through the relay control after completion of predetermined number of revolutions of standard. Full-load and light-load standard tests meters are shown in lower left and lower right respectively.

This system also includes a series of fixed spring contacts which facilitate the connections of the meters on the racks and their removal therefrom with a minimum amount of handling. In operation a rackful or group of eighty meters, for which the standard racks are equipped, is quickly set in place. All meter disks are set at a predetermined point by means of the marking on the disk. The push button is then operated, and this starts all the meters under test at the moment when the continuously operating standard meter makes contact through the automatic-relay counter, a process which insures the simultaneous starting of all meters in synchronism with the master meter. The automatic relay counter having been set for a certain number of revolutions of the master meter, the potential circuits of the meters under test are opened and the meters are thereby stopped, the position of the disk marks indicating which of the meters are correct and the extent to which any may be fast or slow.



FIXED SPRING CONTACTS, SHOWING CONNECTION OF METERS TO RACK WITH MINIMUM HANDLING

Two standard meters are provided, one for full load and the other for light load. These meters are checked with a rotating standard each day before routine testing is begun. A throw-over switch operates the system in connection with the one or the other of these standard meters, and hence both full-load and light-load tests are obtained while the meters under test are in position on the racks. The full-load test is conducted over a time interval represented by ten revolutions and the light-load test one revolution.

Only 5-amp. meters are tested by this method, but as this size meter comprises about 85 per cent of the Consolidated company's 149,772 meters in service on December 31, 1924, it has been a great help in facilitating the proving of new meters and testing those that have been taken out of service. With this system four men making adjustments on the meters under test can complete four rackfuls, or 320 meters, in one day. This is at the rate of eighty meters per man per day as against about thirty when testing individually.

During 1924 the Consolidated company tested 22,901 meters in this manner, and each meter bore the inspection seal of the Maryland Public Service Commission.

Small Diesel Plant in New Mexico

BY MARTIN MICHEL
Superintendent Light and Power
Muresco Electric Light Plant
Alamagordo, N. M.

WHAT a small plant can accomplish with Diesel engines may be ascertained from the experience of a 150-hp. Diesel-engine installation at Alamagordo, N. M., which operated for the year 1923 at a cost of 4.99 cents per kilowatt-hour.

The figures given in the table herewith for depreciation are average costs over a period of ten years for repairs and maintenance of plant buildings, etc. The present status of this engine (purchased in 1914) as a prime mover does not give many data to use as a guide in determining depreciation or obsolescence, because all wearing parts have been replaced, thus producing an appearance as good as new, and because under high load factor its efficiency is virtually as good as that of a later model. Under the insurance section the figure of 0.246 cent per kilowatt-hour is further subdivided into: Fire, 0.089 cent; flywheel, 0.007 cent, compensation, 0.150 cent.

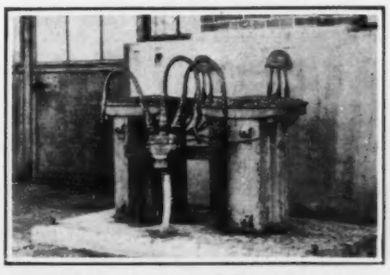
TOTAL COST FIGURES FOR DIESEL ENGINE PLANT FOR 1923

Generating rating, kw.	80
Number of units	1
Horsepower of engine	150
Engine purchased	1914
Load factor, per cent	19.1
Plant factor, per cent	15.4
Output, kw.-hr.	134,616
Peak load, kw.	85
Fuel consumed, lb.	186,112
B.t.u. per lb.	19,000
Price per lb. delivered, cents	0.645
Lb. fuel per kw.-hr.	1.38
B.t.u. per kw.-hr.	26,220
Classification	Municipal
Cost of fuel per kw.-hr., cents	0.890
Cost of wages and superintendence, cents	2.580
Lubrication, cents	0.164
Maintenance of engine, cents	0.054
Miscellaneous, cents	0.036
Total maintenance and operating cost per kw.-hr., cents	3.724
Insurance per kw.-hr., cents	0.246
Depreciation per kw.-hr., cents	0.370
Amortization per kw.-hr., cents	0.560
Interest per kw.-hr., cents	0.090
Total fixed charges, cents	1.256
Total fixed and operating charges, cents	4.990

Using a Fulton Diesel driving an 80-kw. generator, the annual output was 134,616 kw.-hr. To generate this, 186,112 lb. of fuel was burned, making an average of 1.38 lb. of fuel per kilowatt-hour. The load on this station consists of combination lighting services and household appliances with small, intermittent motor loads.

Accessible Transformer Mounting

IN A MASSACHUSETTS repair shop a convenient mounting of lighting transformers illustrated herewith places the units on a con-



INDUSTRIAL TRANSFORMER BANK WITH LOW MOUNTING BASE

crete mat about 6 in. above the ground level, the primaries (550-volt, three-phase) being supplied by a lead-covered cable run to the bank from an underground duct line and terminating in a pothead clamped on a wooden frame of 2-in. x 3-in. stock, which in turn is bolted by ⅜-in. bolts to the transformer cases. The secondary leads (110-220 volts) are taken into the building through conduit fittings, and the transformer bank is inclosed by a screen.

Commercial Activities and Public Relations

Clearing Radio Interference Gains Good Will

A PHASE of public relations of much importance to the central-station company is the detection and removal of line troubles capable of interfering with broadcast reception as soon as possible after their presence is manifested. The promptness and skill with which these disturbances are cleared away intimately affect local public opinion, and utility executives are devoting no little consideration to this matter.

W. P. Schwabe, vice-president and general manager Northern Connecticut Light & Power Company, Thompsonville, Conn., recently received a letter of such keen appreciation from a customer whose radio reception had been impaired by a line leak remedied within a few hours of the complaint that the letter and Mr. Schwabe's reply, setting forth the company's service aims and policy, were published in a local newspaper advertisement. The letters are reproduced herewith.

EXAMPLE OF MUTUAL APPRECIATION

Northern Connecticut Light & Power Company, Thompsonv lle, Conn.

Gentlemen: I wish to write you and thank you for the co-operation of the Northern Connecticut Light & Power Company and that of your Mr. Smith and Mr. W. L. Nutting.

You will recall that the other evening I called you up and stated that a radio expert said there was a bad power leak near my home, at the corner of King and Pleasant Streets, in Enfield, which was causing trouble with my set. At your suggestion I called Mr. Smith, who in turn said that he would get in touch with one of his men. I expected that some time in a month or so somebody would drop in and ask what we expected the power company to do about it and that my radio pleasure would be ruined.

Imagine my surprise when that same evening within a half hour Mr. Nutting called. I demonstrated the reason why I thought there was a power leak, which seemed to point specifically to the transformer on King Street in the front of the house. Mr. Nutting frankly said he did not want to climb a pole that night, and naturally I said I did not expect any such action, but early next morning a crew was there, the trouble was righted and I am happy; but my happiness will not be complete until I extend to you the thanks of myself, my family and those friends who may come in to enjoy the music from the air.

I trust you will pass on to both Mr. Smith and Mr. Nutting my appreciation. Sincerely,

J. W. LONGNECKER.

Mr. John W. Longnecker, King Street, Warehouse Point, Conn.

Dear Mr. Longnecker: This is to acknowledge receipt of your letter of December 18, with thanks. In general our customers take the service that we are rendering as a matter of course, and it is gratifying that once in a while a customer takes the trouble to let us know that in some particular instance our service has been appreciated. It also gives us an opportunity to know that our employees are doing what they can to carry out the policy of the company.

I assure you it was a pleasure to receive your letter, and if you have no objection I would like the privilege of using it for publicity. Yours very truly, WALTER P. SCHWABE,

Vice-president and General Manager.

Industrial Electric Heat Applications

WITHIN the last two years the Worcester (Mass.) Electric Light Company's power engineering department has added twenty-four industrial electric heating installations, aggregating 225 kw., to the connected load of the system, resulting in an estimated increase in yearly energy sales of nearly 350,000 kw.-hr. and yielding from $35 to $45 per kilowatt connected per annum. Nearly every variety of heat-treating of steel is represented in these installations with the exception of high-speed steel, and the Worcester manufacturers are well pleased with the increased production and improved quality of work turned out by electric furnaces.

Gas, coal and oil have been displaced in typical cases, with marked benefit to the convenience and comfort of employees, and the installations range in capacity from a few kilowatts up to 45 kw. As shown by the illustrations on the opposite page, these are medium-sized and small applications, which fit the diversified needs of varied metal-working industries. Automatic control of temperatures is common and recording temperature charts are freely used. These furnaces are of American Metallurgical, General Electric, C. I. Hayes, Hoskins, Leeds & Northrup and Westinghouse make, and about two-thirds were put in in 1924.

Special training in industrial electric heating under N. E. L. A. and manufacturers' auspices helped equip the Worcester company's staff to develop this rapidly growing load. The central-station company usually finances these installations on a term basis of payment, and most of the furnaces will probably pay for themselves out of savings effected in two or three years. E. D. Learned is in charge of the Worcester Electric Light Company's power engineering department.

Test Shows Large Field for Kitchen Lighting Units

FOLLOWING a successful two weeks' test campaign in December, during which 580 kitchen lighting units were sold, the Southern California Edison Company launched a campaign on January 1 to cover its entire system. To get the response of the public to the use of increased lighting in the kitchen, the company chose a district having a population of approximately 100,000, with 20,000 consumers, for a test campaign.

The results were so successful and the salesmen so well received that the company decided to cover its whole system with a kitchen-lighting-unit drive beginning the first of the year. In the test campaign the salesmen found that 25 per cent of the people were not at home. Ten per cent of those interviewed purchased units, the net result being an increase of 40 watts in the average lamp size.

At the end of a fifteen-day trial period if the customer was not entirely satisfied with the unit it was removed and the old fixture replaced. Where sales were made 75 cents a month was added to the customer's lighting bill until the total amount of $6.75 was paid. Units were installed by local contractor-dealers as soon as possible after sales were made.

In the general campaign over the company's property the same plans will be followed.

Industrial Electric Heating Installations in Worcester

1. Four years' service by this drawing oven with no repairs is reported by the Greenman Steel Treating Company.

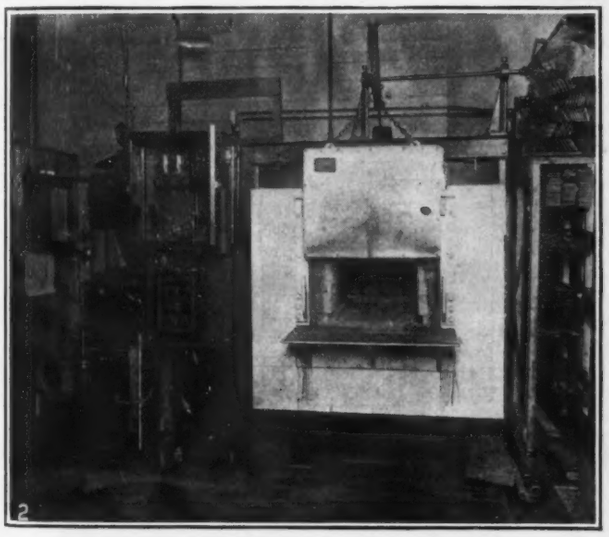
2. Tool steel and brass are annealed electrically by the Nutting Manufacturing Company, with superior uniformity in the product. Three-fourths of the former time required is saved.

3. The Coates Clipper Manufacturing Company reports 50 per cent less fuel cost, 83 per cent less labor cost, a reduction in the number of rejected pieces of 80 to 100 per cent and the elimination of scratch-brush operation in hardening clipper plates.

4. Eighteen months' service by two furnaces in the plant of the O K Locknut Company has improved production and quality manufacture. The furnace at the left heat-treats chrome-vanadium steel washers at 1,700 degrees F., with a 5-deg. automatic temperature control. The right-hand furnace does tempering work around 900 deg.

5. In tempering high-speed steel taps the John Bath Company finds the electrical method cleaner than the use of lead salts and that more work can be done in a given time. From 800 to 1,000 deg. F. is required, and the usual 5-deg. limit of temperature control is automatically obtained.

1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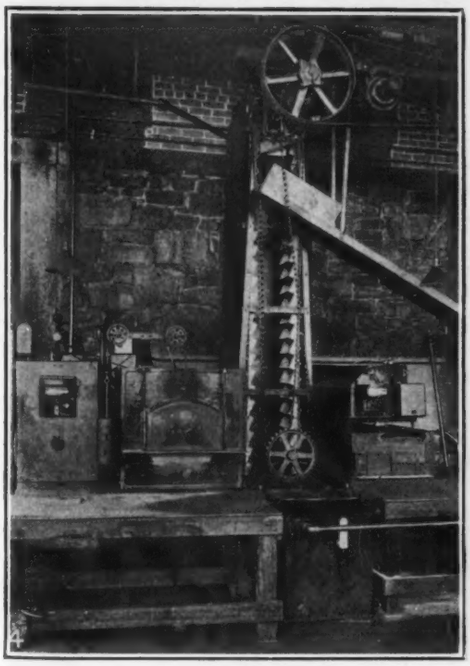
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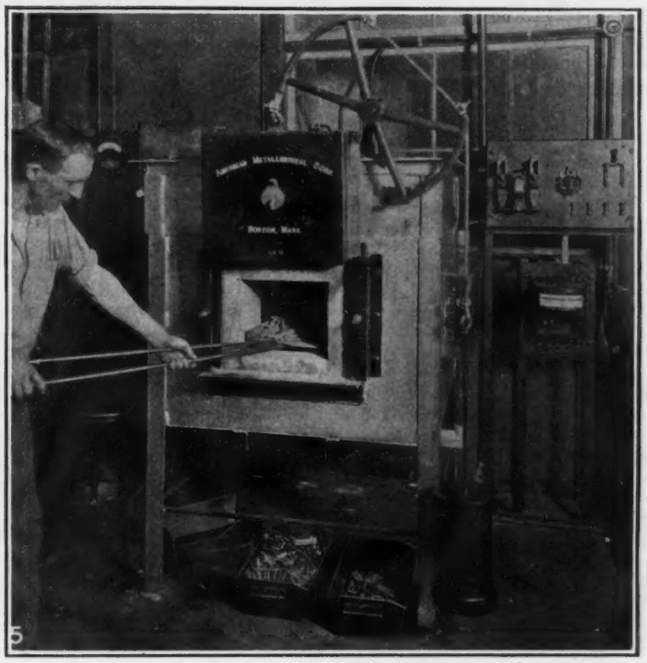
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Campaign Selling in a Small City

BY L. B. MICHAELS

L. B. Michaels Company, Pittsburgh, Pa.

IN MANY cities where the electric light and power company serves from 3,000 to 10,000 meters the use of special sales campaigns to put additional load upon the lines is seldom considered, yet these are the places in which campaigns are the easiest to operate and supervise and in which the most productive results can be realized. A kitchen lighting-unit campaign recently conducted by the Lockport (N. Y.) Light, Heat & Power Company, which has approximately 5,000 meters connected, illustrates what can be accomplished by this method in a town of this size.

About six hundred units were sold, net sales after all removals amounting to one to every ten meters. Gross volume in Lockport was a secondary consideration.

In planning the drive in Lockport three ideas were kept in mind: (1) Further development of good will among consumers; (2) increasing residential customers' use of energy; (3) gaining a merchandise profit.

In order to accomplish these results four principles were considered necessary: (1) Salesmen who know how to think straight; (2) complete co-operation, in deed as well as spirit, by all company employees; (3) a first-grade unit; (4) a workable proposition.

The following essential features of the drive offer a number of suggestions that could easily serve as a model for central-station companies in other cities:

Prices and Terms.—Plain unit, without pendent plug, time or cash, $7.95; with pendent plug, time or cash, $8.95. (Note that there was only $1 difference in price between the two types.)

Stock on Hand.—After the campaign started stock was kept on hand at all times. This was and is always an important consideration.

Installations.—Delivery and installation of orders were taken care of nearly always the day the order was written. Truck and fitters accompanied the salesmen, waiting on the corner for orders. Old fixtures were wrapped up for the patron. Fitters were especially instructed in regard to courtesy.

Lists of Consumers.—Salesmen received lists of consumers taken from the addressograph. The advantages are obvious.

The Unit.—"Cora" glass with "Only" fitter and 100-watt lamp; pendent-plug equipment optional.

Advertising. — Half page in daily papers at intervals during the campaign, written in such a manner as to announce the salesman's call and to influence the patrons to keep lights placed on trial. Banners reading, "Watch for the man with the great white light," were placed on all the company's trucks. The publicity was tied in with window displays throughout the campaign.

Compensation.—Salesmen were paid on commission basis at the rate of $1.50 per fixture installed, including extra bonuses as each man attained his first hundred installations of lamps with pendent plug; plain (without pendent plug) did not count. In addition, an extra bonus prevailed on pendent-plug units in excess of 100 during the campaign. Commissions were paid promptly each week on a certain day.

Watch for the Man
With the Great White Light
He is on his way to your house with
DUQUESNE
KITCHEN
LUMINAIRE
PLACED ON TRIAL
For Ten Days Free of Charge
Unless you notify us to remove the light within ten days the monthly payments will be added to your electric bills.
EASY TO TRY, EASY TO BUY AND EASY TO LO OK AT
You Owe It to Yourself
And Family
TO LIGHT YOUR KITCHEN WITH THE SOFT, RADIANT AND PLENTIFUL ILLUMINATION OF THIS NEW, MODERN ELECTRIC UNIT. YOUR NEIGHBOR HAS ONE.
DELIVERY AND INSTALLATION
FREE OF CHARGE
LOCKPORT LIGHT, HEAT & POWER CO.
PHONE 383

TYPICAL HALF PAGE ADVERTISEMENT OF KITCHEN LIGHTING UNIT

Office Orders.—All orders and prospective orders for kitchen units from any source were turned over to the salesmen, who received full credit.

No Deductions for Removals.—There were no deductions for removals from the salesmen's commissions, and they received all that was due them each week, nothing being withheld.

Inspection. — An inspector made a second call upon each customer within ten days of installation with the object of checking sales, reselling the job if necessary or getting a definite decision as to whether the unit would have to be removed. It is believed that this inspection system resulted in a greater number of removals than would have resulted without the second call (20 per cent were removed), but those that did not come out in ten days were good solid sales.

Removal Insurance. — An amount of 50 cents per unit sold (net sales) appeared in the original "set-up," intended to cover every possible expense incident to the removal of units. These expenses included installation, removal and commissions paid to salesmen. As high as 25 per cent of the total placed on trial could be removed on this plan and black ink would still be shown on the ledger opposite the item of removal expense.

It will be seen that the salesman got the best of it whenever it could be given to him. Two things have been learned, both of which were taken advantage of in the Lockport campaign. The first of these is that the placing of kitchen units is not so easy as it seems to be. The average over a number of campaigns is not far from ten installations per day per man. In many campaigns it is nearer six. Wildcat salesmen can "rough in" twenty to thirty units per day—removing 60 per cent of them.

The second thing is that the methods of some salesmen can wreck a campaign. Wrong methods have been known to spread ill will, make net sales few and bring about a loss on the units without increasing the energy sales.

The price must be high enough to cover the various expenses incident to doing a first-class job. Many campaigns have failed either because the price was too low or because the "set-up" was not properly proportioned. The Lockport company has improved good will by improving service, has materially increased its domestic electric revenue and has made a small net profit on the units themselves.

The campaign was conducted under the direction of M. J. Healy, commercial manager of the Lockport Light, Heat & Power Company, with James Miller, campaign manager of the L. B. Michaels Company, actively in charge of two salesmen operating in the field.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

High Bridge Steam Plant at St. Paul.—The station described and illustrated is a base-load plant to supplement the water power of the Northern States Power Company. The initial installation consists of two 30,000-kw. units, but ultimately the generating capacity is to be at least 240,000 kw. The design includes nothing radical. Underfeed stokers, two-stage bleeding and both steam-driven and dual-drive auxiliaries are used. Silt, city sewage and manufacturing wastes in the river water necessitated purification to make it fit for boiler use. This is effected by evaporators. Provision is made for keeping ice off the trash racks. The article includes an analysis of construction costs by percentages and a page of details regarding the equipment.—*Power*, Dec. 23, 1924.

Development of Hydraulic Turbines in Norway.—N. DE L. KOBBERSTAD.—The author gives a historical sketch of the development of the means for utilizing water power from the earliest flour mills to the modern hydro-electric power plants.—*Teknisk Ukeblad* (*Norway*), Dec. 6 and 8, 1924.

Muscle Shoals One of the World's Largest Water Powers.—The article reviews the history of the Muscle Shoals development, shows its location with reference to adjacent transmission lines and principal cities within a radius of 350 miles, records the progress thus far made in the construction of dams, power houses, including the Gorgas steam plant, and nitrate plants, gives a résumé of the four offers made to the government for the project, and concludes with a discussion of the feasibility of the fixation of atmospheric nitrogen by large-power electrical methods in view of the present trend toward more strictly chemical processes. Of the 850,000 hp. to be developed a plant at Dam No. 2 for 600,000 hp. is nearing completion with 260,000 hp. installed. Data are given as to stream flow, costs and many physical features of the undertaking.—*Power*, Dec. 30, 1924.

Development of the Norwegian Electrical Industry.—V. GIAEVER ENGER.—The author gives a historical review of the growth of the Norwegian electrical industry since its beginning in 1877.—*Teknisk Ukeblad* (*Norway*), Dec. 6, 1924.

Generation, Control, Switching and Protection

Predicting Central-Station Demand and Output.—FARLEY C. RALSTON.—In this paper the nature of seasonal variations in the daily load curve of a particular company is investigated. By plotting the "normal mid-week day" outputs on logarithmic paper a curve is obtained which approximates a sine curve superposed on the straight line of annual increase. For studying the short-peak demand the daily load curve is separated into three components, base load, afternoon peak and evening block, the characteristic shapes of which have been determined. The growth of each can be studied independently. The analysis presented is both graphical and mathematical.—*Journal of A. I. E. E.*, January, 1925.

Oil-Circuit-Breaker Investigations to Determine Interrupting Capacities.—J. D. HILLIARD.—The article is reprinted from the *Journal of the A. I. E. E.* for September, 1924. It contains oscillograms taken under various conditions with the aid of generating equipment capable of producing short circuits of 300,000 kva., three-phase, and higher values on single-phase tests. The information they shed on circuit-breaker action is discussed.—*General Electric Review*, December, 1924.

Oil - Circuit - Breaker Design.—The construction of a form of large-capacity unit made by the Oerlikon Company is described and illustrated. Gas chambers permit of the escape of the greater part of the gases into the open, but also use the pressure for blowing out the arc and accelerating the motion of switching off.—*Electrician* (*England*), Jan. 2, 1925.

Transmission, Substations and Distribution

High-Tension Cables.—LLEWELLYN B. ATKIN.—This abstract of a World Power Conference paper is a non-mathematical discussion taking up temperature limits, problems of heat disposal, impregnation and the geometry of cable design.—*Electrician* (*England*), December 19, 1924.

Three-Winding Transformers.—J. F. PETERS.—In some cases three sections of a high-tension network, operating at different voltages, are tied together by means of one bank of transformers. This requires three-winding transformers so designed that power may flow in any combination of ways between the sections and not suffer prohibitive voltage regulation. The present article deals with the subject analytically. The author takes as his starting point the impedances of the windings taken in pairs, which can be measured in the ordinary way. These are combined into an equivalent impedance network and a method developed for computing regulation, the application of which is illustrated by a problem. A graphical method is given for determining the permissible load on one of the windings under specified conditions. Parallel operation is discussed. The article is to be continued.—*Electric Journal*, January, 1925.

Testing Method for High-Voltage, Three-Phase Cables.—P. CAPDEVILLE.—To determine dielectric losses and the performance of a three-phase cable, single-phase, high-voltage testing of its individual conductors is insufficient. Not only should the test be made with high-voltage, three-phase current on all three conductors simultaneously, but rated current should at the same time be made to flow through the cable. This would, of course, call for testing equipment of very high power which is not available in a manufacturing plant. The author describes a simple method whereby a testing outfit of about 100 kva. is sufficient to test a three-phase cable for 400 amp. at 120,000 volts, or an energy of 83,000 kva. The three conductors of the reeled cable are closed in themselves over three-current transformers, through which the rated current is induced in each conductor. At the same time a high-voltage, three-phase testing transformer brings each conductor to the desired high potential against the other conductors and ground. It is, of course, necessary to have the primaries and secondaries of the three-current transformers fully insulated from one another and from ground to withstand the applied high potential of the three-phase transformer. The use of this method to measure cable losses is described in detail.—*Revue Générale de l'Electricité*, Dec. 6, 1924.

Units, Measurements and Instruments

Methods of Testing Electrical Apparatus.—Tests are summarized as to kind; suggestions are given for making records, plotting curves, drying apparatus and finding insulation resistance.—*Electric Journal*, January, 1925.

Results of Magnetic Observations.—D. L. HAZARD.—The results of observations made at the United States Coast and Geodetic Survey Magnetic Observatory at Cheltenham, Md., in 1921 and 1922 are given. Hourly values of declination, horizontal intensity and vertical intensity for 1921 and 1922 are given.—*Serial No. 275 of the United States Coast and Geodetic Survey.*

Economic Balance in Electrical Transmission.—PHILIP CHAPIN JONES.—In spite of the universality of its teaching, Kelvin's law has not been so much followed in actual work as it should be and has drawn much adverse criticism as being of little practical value. The writer shows the mathematical derivation of the law and its essential validity, but points out that the constants must be properly evaluated to take account of load fluctuations and elements of cost other than that of copper. He shows how this may be done. To give a concrete example, a table is presented giving the optimum peak current for each wire size under stated conditions. He concludes that many circuits are undercoppered, with consequent economic loss.—*Electric Journal*, January, 1925.

Illumination

Effect of Color of Walls and Ceilings on Resultant Illumination.—A. L. POWELL.—The author has brought together a considerable body of data and other information from various sources concerning the effect of aging on the reflection coefficient of different kinds of white paint, tabulated values for commonly used color, actual samples of ceiling and wall tints, dado paints, wall papers and wood finishes with the corresponding coefficients for light from "Mazda" lamps, and suggestions regarding the choice and method of appli-

cation of paints and other interior finishes. References are given to original articles.—*Bulletin L. D. 102A, Edison Lamp Works of General Electric Company.*

Studies in the Projection of Light: Design and Optics of Second-Surface Mirrors.—FRANK BENFORD.—The previous installments of the series, of which this is Part XV, have been noted in the Digest. The present analysis deals first with the second-surface mirror with two plane faces and shows, among other things, that the apparent point of virtual reflection is at a variable depth in the glass, depending on the direction of the incident ray. The hyperboloid and ellipsoid, with their co-surfaces, are then considered.—*General Electric Review*, December, 1924.

Motors and Control

Method of Starting Asynchronous Motors Without a Rheostat.—Prof. K. I. SHENFER.—The method consists in using as a starting rheostat a part of the windings of the rotor when these windings are suitably connected. A detailed mathematical theory of the method is given. The theory was verified on two motors, one rated at 10 hp. and the other at 60 hp. The method offers certain advantages.—*Electrichestwo*, No. 2, 1924.

Complete Synchronous-Motor Characteristics.—JOHN F. H. DOUGLAS, ERIC D. ENGESET and ROBERT H. JONES.—By using a double unit the authors have been enabled to determine the excitation characteristics and the torque experimentally through the complete cycle, including the so-called unstable part. They also investigated the variation of synchronous impedance with saturation and power factor and found it to be about 50 per cent higher at zero than at unity power factor. Differences from published curves determined by theory are discussed.—*Journal of A. I. E. E.*, January, 1925.

Dynamic Balance of Small High-Speed Armatures.—WILLIAM E. TRUMPLER.—While static balance may be sufficient for small motors operating at lower speeds, accurate dynamic balance is not only desirable but essential for the life of the bearings and of the motor in general when speeds as high as 10,000 to 12,000 r.p.m. are employed. The author describes in considerable detail the construction and functioning of a machine sensitive to an unbalance of 0.00001 lb. at a radius of ½ in., by which the operation of balancing takes but fifteen seconds. Including the applying of the correcting weights about three minutes is consumed per armature. Drawings and views are shown.—*Electric Journal*, January, 1925.

Electrophysics, Electrochemistry and Batteries

Direct-Current Corona in Various Gases.—F. W. LEE and B. KURRELMEYER.—Going forward from the work of previous investigators, whose results are briefly reviewed (with bibliography), the authors have investigated the relation between critical corona voltage and pressure in helium, hydrogen, oxygen, nitrogen, air and carbon dioxide. The results are given in curves for the range from 2 mm. to 300 mm. of mercury. The general shape is the same for all gases, the critical voltage rising in a somewhat less than linear relation, but the values vary widely. Except for the lowest pressures, the order of the gases for critical intensities is the same as for the mean free path of the molecule. Apparatus, methods and provisions for securing accuracy are described.—*Journal of A. I. E. E.*, January, 1925.

Studies of Electric Discharges in Gases at Low Pressures: Use of Spherical Collectors and the Effects of Magnetic Fields.—IRVING LANGMUIR and HAROLD MOTT-SMITH.—This is Part V of a series of which the earlier articles have been noted in the Digest. It presents additional experimental data relative to the use of spherical electrodes and then takes up the effect of magnetic fields on the discharges. Starting from the differential equations of Townsend for the mobility of ions in a magnetic field, a theory of these effects is developed and a comparison made with experimental results. The installment concludes with an explanation of Goldstein's experiments.—*General Electric Review*, December, 1924.

Traction

Railway Electrification—An Urgent Problem.—SIR PHILIP DAWSON.—The article presents vigorously the case in favor of prompt and complete main-line electrification in Great Britain, in the light of economic necessity and of experience abroad. Freight rates in various countries are compared, and methods of financing are suggested.—*World Power*, January, 1925.

Conversion of Part of the Metropolitan Railway to Electric Traction.—Twenty-three single-track miles on the Harrow-Rickmansworth section of this line have been converted from steam to electric operation. The new construction is briefly described and illustrated.—*Electrician (England)*, January 9, 1925.

Telegraphy, Telephony, Radio and Signals

Construction of the Towers for the Radio Station at Varberg, Sweden.—H. KREUGER.—This article describes in detail the design and building of the antenna structure for the radio station at Varberg, Sweden. The structure consists of six individual towers, 400 ft. in height. The antenna wires are twelve in number and carried on cross-arms, 150 ft. wide, at the top of each tower. The towers are spaced at a distance of about 1,250 ft., so that the entire structure has a length of about 7,350 ft. between the points of attachments of the antenna wires. The carrying capacity for vertical load of each tower is about 95 tons for the end towers and about 79 tons for the intermediate ones. The antenna wires are made of phosphor bronze and consist of nineteen conductors, 0.075 in. in diameter, so that the external diameter of the wire is about ⅜ in. In order to prevent destructive overloads on the towers the wires are suspended in specially designed connections intended to break at a vertical load of about 4,000 lb. By this arrangement the towers are relieved of the load from the antenna in case of extreme wind conditions.—*Teknisk Tidskrift (Sweden), Väg-och Vattenbyggnadskonst*, December 27, 1924.

Review of Wireless in 1924.—G. W. O. HOWE.—Progress in short-wave transmission is summarized. Achievements in this field have directed attentions of this subject with a very comfor wave propagation around the curvature of the earth. The explanation seems to lie in a decrease in the specific inductive capacity of the upper atmosphere. Theories to account for this have been put forward by Eccles and Larmor.—*Electrician (England)*, January 9, 1925.

Sir Joseph Larmor's Theory—Why Wireless Waves Can Bend Round the Earth.—G. W. DE TUNZELMAN.—The author discusses, in somewhat mathematical language, a theory proposed by Larmor in a paper read before the Cambridge Philosophical Society and published in the *Philosophical Magazine* for December. The diffraction theory, suggested in the early days, he points out, is untenable because by analogy it would require that visible light should eurve perceptibly around a 6-cm. sphere. A later assumption was that of the conducting "Heaviside layer." But ordinary conduction, reflection and refraction operate by introducing a frictional term; if the change of speed is to be adequate, the rays would be damped out immediately. To produce sensible bending of the rays without extinction the influence must be of the dielectric type and such that any accompanying dissipation will occur only in the way of secondary effects of exceeding smallness. A sufficient cause for the increase of velocity, without dissipation, for waves traveling horizontally is afforded by the free oscillations of ions sparsely distributed in the very high regions of the atmosphere, where the mean free path is long enough to permit them to swing freely, in the main, under the influence of the changing field. Lower down the energy of the ions would be dissipated by collision with the atoms and the traveling waves would be gradually quenched. The assumption is examined quantitatively as to short and long waves and by application of the formulas for curvature of light. There is also a brief editorial résumé in the same issue.—*Electrician (England)*, January 9, 1925.

Miscellaneous

Power Consumption for Heavy Steel-Plate Mills.—C. S. SKOG.—The author gives results from the latest investigations of this subject with a very complete bibliography.—*Teknisk Tidskrift (Sweden), Bergsvetenskap*, December 13, 1924.

Reorganization and Standardization.—HUGH QUIGLEY.—This article, while concerned with economic rather than with technical problems, is of interest from the electrical engineering aspect because of the writer's advocacy of intensive industrial electrification, standardization of frequency to permit of general interconnection of entire national power systems without frequency changers—he cites the bold policy recently adopted in France despite its initial cost—and railway electrification.—*World Power*, January, 1925.

News of the Industry

Muscle Shoals Dilemma

Problem of Fertilizer Production Is Serious One to Members of Conference Committee

IN THEIR efforts to reach an agreement on the Muscle Shoals bill the conferees for the Senate and the House find themselves between Scylla and Charybdis. If they do not make the fertilizer requirements less drastic, they realize that there is no hope of obtaining private bids. On the other hand, if they modify the fertilizer requirements, they face the rejection of their report. Nevertheless, their difficulties are not regarded as insoluble. One thing is certain, however, no legislation can be made satisfactory to those who dabble in fertilizer manufacture in order to get the power. The question is turning on how much power subsidy will be required to interest those who would undertake the manufacture of a certain amount of fertilizer. It is believed that no one is willing to make as much fertilizer as is called for by the Underwood bill even with all of the subsidy that it could be hoped to realize from the power. If the power payment should be reduced to 4 per cent on the cost of the dam, less the $17,000,000, and should the payment for power during the first six years be no more than $200,000 per year, as proposed, it would subsidize the fertilizer production to the extent of $14,000,000 for that period, it is believed.

At the request of the President the conferees called in the Secretary of War and the Secretary of Commerce and heard their views on the legislation.

Henry Ford has offered to turn his nitrate experts and the results of their research over to the government if it undertakes to operate Muscle Shoals on its own accord.

West Penn's Subsidiaries in Three States Consolidated

It has been announced by A. M. Lynn, president of the West Penn Company, that a consolidation and unification of all the electric light and power companies of the West Penn System within West Virginia, Ohio and Maryland has been effected. This has been accomplished by transfer to the Monongahela West Penn Public Service Company of all the physical properties and assets of the Brooke Electric Company, operating in Brooke, Hancock and Ohio Counties, W. Va.; of the West Virginia & Maryland Power Company, operating in Preston, Taylor, Barbour, Randolph and Mineral Counties, W. Va.; of the Parsons Electric Company, operating in Tucker County, W. Va.; of the West Virginia Public Service Company, operating in Upshur County, W. Va.; of the St. Mary's Power & Light Company, operating in Pleasants County, W. Va., and of the West Maryland Power Company, operating in Garrett County, Md.

The consolidation of these companies, the announcement says, makes the Monongahela West Penn Public Service Company, already operating in Monongahelia, Marion, Wetzel, Tyler, Wood, Harrison, Lewis, Barbour and Braxton Counties, W. Va., and Washington County, Ohio, the largest and most extensive public utility within the State of West Virginia. The West Penn Company, which is controlled by the American Water Works & Electric Company of New York, is likewise the owner of the West Penn Power Company.

The operation and management of the Monongahela West Penn Public Service Company will continue under the administration of George M. Alexander, president, with headquarters at Fairmont, W. Va.

In Readiness for Midwinter A. I. E. E. Convention

Everything is in readiness for the midwinter convention of the American Institute of Electrical Engineers, to be held at the Engineering Societies Building, New York, next week from Monday to Thursday. The program of the convention was printed in the ELECTRICAL WORLD for January 17, page 166.

Among the social functions will be the smoker on Monday evening and a dinner-dance on Thursday evening (Lincoln's Birthday). Both of these events will be at the Hotel Astor.

No Action Yet on "Power Trust" Motion

Modified Resolution for Investigation of General Electric Company Is Reported from the Senate Committee, Which Norris Reluctantly Accepts

AS THE ELECTRICAL WORLD goes to press no action has been taken in the United States Senate on the resolution ordering an investigation of the General Electric Company on the ground that it monopolizes or controls electric light and power company business. The resolution was returned to the Senate by its interstate commerce committee in a greatly modified form, which was rather reluctantly accepted by Senator Norris, the father of the original motion. It had been planned to take up the resolution on Thursday, the day following its return to the Senate, but consideration of the nomination of Attorney-General Stone to be a justice of the Supreme Court prevented. Objection is being voiced to the inclusion of security holders in the resolution, the text of which as reported out of the committee is as follows:

TEXT OF RESOLUTION

"Whereas it has been alleged during the course of debate upon a bill relating to the disposition, operation, maintenance and control of the water-power and steam-power plants, with their incidental lands, equipment, fixtures and properties, that a corporation known as the General Electric Company has acquired monopoly or exercises a control in restraint of trade or commerce, in violation of law, of or over the production and distribution of electrical energy and the manufacture, sale and distribution of electrical equipment and apparatus; it is

"Resolved, that the Federal Trade Commission be and it is hereby directed to investigate and report to the Senate to what extent the said General Electric Company or the stockholders or other security holders thereof, either directly or through subsidiary companies, by stock ownership or through other means or instrumentalities, monopolizes or controls the production, generation or transmission of electrical energy or power which is produced by steam, gas or water power, and report to the Senate the manner in which the said General Electric Company has acquired and maintains such monopoly or exercises such control in restraint of trade or commerce or in violation of the law.

"Resolved further, that the President of the United States be and he is hereby requested to direct the Secretary of the Treasury under such rules and regulations as the Secretary of the Treasury may prescribe to permit the said Federal Trade Commission to have access to official reports and records pertinent thereto in making such investigation."

Young Welcomes Inquiry

Owen D. Young, the chairman of the board of the General Electric Company, asked about the Senate's resolution of inquiry into General Electric activities, said the General Electric Company has no objection to such an inquiry being made into its affairs.

"Burdensome and expensive as it is to a business organization, it is better than unfounded charges based on misinformation," he said. "The resolution, however, not only directs an inquiry into the shareholding of the General Electric Company and its subsidiaries, but also into the holdings in other companies of its individual shareholders and bondholders. One would think that such a governmental inquisition into the private affairs of more than thirty thousand persons was not only unnecessary for the purposes of the resolution, but unjustified in principle and undesirable as a precedent."

For St. Lawrence Power

New York State Water Power Commission Thinks Time Has Come to Develop It

OUT of deference to Governor Smith's policy of state ownership and development of water power, the New York State Water Power Commission in its fourth annual report just submitted to the Legislature announces that it has continued to withhold approval of all applications of permits for private development. Twenty-five such applications have been received since the enactment of the law four years ago under the administration of Governor Miller.

The report makes a recommendation for the immediate development of potential water power in the St. Lawrence River, saying:

"The tremendous growth in the demand for electric power and the advance in transmission make it feasible to develop the St. Lawrence power at this time, whereas at the time of the early studies such development was out of the question. No one desires water-power improvements on the river that cannot be adapted to the full utilization of power. Similarly no one desires water-power developments that do not conform to navigation requirements."

Discussing co-operation between the United States and Canada and the need of a new treaty, the report differentiates between the proposed developments and waterways for navigation as follows:

"The development of water power on the St. Lawrence River should not be made dependent on navigation improvements, and development of power should be permitted to proceed at as early a date as feasible, leaving navigation improvements to proceed if and when determined upon. An early development of the St. Lawrence River power will effectively stop the belittling of the damage caused by the Chicago diversion for the reason that no use is made of the water."

Reference is made to the action of former Attorney-General Sherman in withdrawing the suit against the Union States government to determine jurisdiction of the boundary waters between the state and the nation and to the fact that Attorney-General Ottinger expects to reopen this suit with a view to fixing the state's status definitely.

POWER FROM NIAGARA GORGE

The report urges an adequate appropriation to defray the necessary expenses of defending New York State's rights in the matter of the Chicago diversion. It emphasizes the possibilities of the development of the 80-ft. fall in the lower Niagara gorge as a means of equalizing the amounts of power derived from the American side of the Falls with that developed on the Canadian side, estimating that 150,000 hp. could be developed there alone on the basis of a diversion of 19,500 cu.ft. per second from the Maid of the Mist pool.

The report reviews the conference with spokesmen for the water-power industry and the Niagara Falls Power Company over the charge to be made for diversion of waters in the Niagara River over and above the 15,100 cu.ft. per second authorized in the company's grant. It says that the excess diversion has mounted from 2,386 cu.ft. per second a year ago to 3,921 cu.ft. per second last December. The commission is still waiting for a counter proposal from the company to the charge of 50 cents per horsepower which it wishes to make with the proviso that the charge be not passed on to the consumers.

Public Ownership Again

Fresh Legislative Moves Made by Its Advocates in Oregon and Washington

WITH the opening of the 1925 session of the Legislature of the State of Oregon comes the announcement by Senator George W. Joseph of Multnomah County that he will again propose a resolution to submit to a vote of the people under the referendum a constitutional amendment authorizing the state to go into the power business. The amendment is similar to the one that the senator proposed in the 1921 legislative session and similar to the one sponsored by the Public Ownership League of Portland last year. Senator Joseph said: "I am convinced that if Oregon is to make any progress in cheap power development the state must take the initial step, and I have so drafted the amendment that the state may proceed with water-power development either independently or co-operatively with the State of Washington or the government, or in co-operation with both."

Another attempt to make it legal for the cities of Seattle and Tacoma, Wash., to sell power outside their corporate limits is the object of a bill said to be prepared for presentation to the 1925 session of the Washington State Legislature. The prospective measure, which would permit any municipality engaged in the electric light and power business to sell energy outside its boundaries provided that the gross revenues from such sales were taxed by the state at the rate of 5 per cent, proposes a compromise between the Bone bill and the Reed bill, both defeated at the November elections. The Bone bill would have allowed such sales tax-free, while the Reed bill would have imposed a 5 per cent tax on the proceeds from all sales, both outside and inside the city boundaries, if any power were sold outside.

Mayor Brown of Seattle has launched a movement for the state ownership of all telephone and electric transmission lines in Washington.

Maine Central to Study Electrification

Murray & Flood, consulting engineers, New York, have been retained by the Maine Central Railroad to investigate and report to President McDonald within six months upon the cost and feasibility of electrifying the main line of the company from Portland to Bangor, including various related yards.

Michigan Electric Power Company Formed

A new corporation, the Michigan Electric Power Company, has been formed to consolidate the Great Lakes Power Company of Bad Axe and Caro, the Lapeer Gas-Electric Company of Lapeer, the Central Power Company and Consumers' Heating Company of Bad Axe and the Caro Light & Power Company, all serving that part of Michigan south of Saginaw Bay and west of Lake Huron which is known as the "Thumb." The new company has an authorized capital of $1,000,000 and will improve its Lapeer properties and build new transmission lines. It will serve more than fifty communities and thousands of farmers and will be the third largest electric light and power company in the state, ranking after the Detroit Edison and Consumers Power.

Seattle to Make Survey of Proposed Skagit Extensions

The City Council of Seattle has named three Seattle engineers to make a survey of the proposed extensions to the Skagit River project, as well as a second commission to study the city lighting system and report on its present and future needs. The Council made it plain that it is not bound by the reports to be submitted, and there is considerable speculation as to its action if the engineers recommend a development contrary to the eight-million-dollar Ruby Creek project which it has approved.

Cleveland City Plant Adds Readiness-to-Serve Charge of 30 Cents

AFTER several weeks' consideration concerning the advisability of raising the rates charged by its municipally owned and operated electric light and power plant or adding a readiness-to-serve charge, the City Council of Cleveland has finally decided on the latter step and will impose an additional charge of 30 cents a month. This action will affect more than 30,000 customers. The previous minimum charge of 75 cents a month also remains in effect, thus making a minimum monthly bill of $1.05 for every one receiving city service.

Some councilmen declared that it would be better to raise the rates than to put on a service charge. The readiness-to-serve charge was, however, held to be necessary by the majority of councilmen in order that a slight reduction could be made to the large users of industrial power.

As reported in the ELECTRICAL WORLD for December 13, 1924, the city authorities of Cleveland plan to expend $1,500,000 in improving the plant. A severe criticism of the management and maintenance of the plant, made by experts employed by the city, was printed in the ELECTRICAL WORLD for August 30, 1924 (page 430).

Boston Edison Rate Hearings Progress

Substantial progress has been made of late in the Boston Edison rate case before the Massachusetts Department of Public Utilities as a result of several days' direct examination of President C. L. Edgar, who was called to the stand by Henry F. Hurlburt, counsel for various customers. The growth of the company's business and its prosperity have been extensively discussed, but thus far the company has had no opportunity to present its own case, and the petitioners have confined themselves largely to attempts to establish a base from which to work toward rate reductions. It is expected that at a later date the company's policies will be fully set forth, and the importance of Mr. Edgar's future testimony in this relation is widely recognized in central-station circles. The case has been before this and preceding commissions for several years, and it now looks as though there would be an opportunity for the company to present its views.

An attempt has lately been made by counsel for the petitioners to attack the uniformity of the company's rates in the forty-two cities and towns it serves. The company has proceeded on the basis of supplying service to the customer in the most remote community reached by its lines at the same rate charged the customer within a mile or so of its generating plant, and this standardization has been an important consideration in the approval of the purchase of suburban companies received from the state authorities. In his direct examination Mr. Edgar recognized that variations in the cost of service might readily occur, but he pointed out that the company's policy has constantly been one of uniform rates under uniform conditions of use, regardless of the geographical situation of the customer.

Ontario Municipal Electric Associations Meet

The annual meetings of the Ontario Hydro-Electric Municipal Association and the Association of Municipal Electric Utilities were held in Toronto on January 28. At the meetings of the former association President Maguire declared additional power plants would have to be provided and that it would be necessary to construct a steam plant in Toronto unless permission were given to build a power dam at Morrisburg, on the St. Lawrence. Resolutions were passed expressing confidence in Sir Adam Beck, chairman of the Hydro-Electric Power Commission, and urging that President Maguire be placed on the commission as the representative of the municipalities.

The following officers were elected for the ensuing year: President, C. A. Maguire; vice-presidents, Willoughby Ellis of Hamilton, J. E. Banwell of Windsor, W. K. Sanderson of St. Thomas and Karl Kranz of Kitchener.

Speaking at the annual banquet, Sir Adam Beck estimated that there would be a million-dollar surplus this year from the municipal Hydro systems based on the revenue for the year of nearly $20,000,000.

The following officers were elected at the meeting of the Association of Municipal Electric Utilities: President, V. S. McIntyre of Kitchener; vice-president, R. H. Starr of Orillia; secretary, S. R. G. Clement of Toronto; treasurer, G. J. Michen of Toronto.

Institute Board Approves Three Standard Sections

The board of directors of the American Institute of Electrical Engineers has approved as A. I. E. E. standards the three following sections submitted by the standards committee: "Standards for Electric Arc-Welding Apparatus" (No. 38); "Standards for Synchronous Converters" (No. 8), and "Standards for Instrument Transformers" (No. 14). The synchronous-converter standards are to become effective six months after the date of official adoption.

The board voted to withdraw from participation in the proposed World's Congress of Engineers at Philadelphia in 1926 in accordance with the recommendation of the joint conference committee of the founder societies. Organization of a Nebraska Section of the Institute, to include Pottawattamie County, Iowa, in which Council Bluffs is situated, was authorized, and a request of the Mexico Section for an extension of territory over the whole of that republic was granted. Six applicants were elected to the grade of member and 198 to the grade of associate.

How Quebec Views It

The cartoon which is here reproduced from the Montreal *Star* is a good pictorial representation of the view of power exportation expressed by Premier Taschereau, as quoted in an interview with the ELECTRICAL WORLD last week, and largely shared by his constituents.

A GREAT OPPORTUNITY FOR CANADA

Alien Promoter—Boss, we got a business proposition. We want you to go into partnership with us in the chicken business. You furnish de chickens an' we takes charge of 'em an' collects de profits. If deys any money left over dat we don't want, you gets it.

Owner of Finest Poultry in North America—Is there anything else you'd like while you're about it?

Bills in Colorado and Tennessee to Abolish Commissions

The abolishment of the state utilities commission of Colorado is asked in a bill just submitted to the Legislature of that state by Senator J. F. Coss of Walsenburg. In its present form the bill provides for the transfer of the commission's supervisory powers to the Attorney-General. According to reports there is a three-cornered fight behind the promotion of this measure. One angle concerns the present power of the commission to regulate common-carrier bus service on the state highways, another the action of the commission in recently granting a franchise to a company for natural-gas distribution, and the remaining reason is the apparent desire to eliminate commission control in the case of those municipalities not functioning under Colorado's home-rule amendment. This chiefly concerns privately owned electric plants.

It is definitely understood that the bill is not a so-called administration measure, yet it has an official relationship with political promotion of cheaper power for Denver and other cities.

A bill has been introduced in the House of Representatives of the Tennessee Legislature to repeal the public utilities law of 1919, which established control of the Railroad and Public Service Commission over the public utilities of the state, including telephone, gas, street-railway and electric light and power companies. This bill passed its first reading on January 27.

The legislative committee of the Federation of Community Civic Clubs of Indiana at a recent meeting decided to recommend to the Legislature the enactment of a bill which would provide that public utilities which allege as a basis of demands for higher rates that the revenue produced by the existing schedule of rates is confiscatory of their property must have a receiver appointed for the company by the state courts before appealing to the federal district court from orders of the Public Service Commission.

New England Lighting School Starts February 10

Chairman Julius Daniels of the Commercial Section, New England Division, N. E. L. A., announces that on February 10-12 inclusive a school for central-station lighting salesmen will be conducted at Boston, under the instruction of illuminating engineers from the Edison, National and Westinghouse Lamp companies. The school will be held at the Rogers Building, Boylston Street, and the tentative curriculum is a comprehensive and well-balanced one.

F. A. Gallagher, Jr., chairman of the Lighting Bureau, New England division, is in charge of the course, the only expense of which will be the student's personal expenses while in Boston. To a representative of the ELECTRICAL WORLD Chairman Daniels pointed out that the course is intended to cover problems of recommendation of lighting equipment and layouts and design and sales promotion methods as well as the latest advances in illumination technique.

McGraw-Hill Men Meet

Business Press Is Maker of Industrial Opinion, Says Hoover—New Standards in Service

FOR the first time in several years all the men of the McGraw-Hill organization met together in New York on January 29, 30 and 31. More than two hundred and forty representatives of the company attended meetings at which notable speakers announced new policies in service and sales for the industrial press.

The following letter from Secretary Hoover to President James H. McGraw —a letter typical of the type of thinking now prevailing in the industrial realm—was received with enthusiasm:

"I wanted to attend your convention to say a personal word of appreciation for the fine service which you, your company and your publications are rendering to American industry. It is a real disappointment to me that I cannot come.

"A big change has come in the spirit of American business, and for this change you are in part responsible. I mean the change from rule-of-thumb and *laissez faire* to scientific determination of facts and program of action based on facts. The business press is probably the greatest force in making industrial opinion. The schools and colleges have an important place; the trade associations can do much in the fields of production and distribution; the government bureaus which keep in contact with business can help to promote sound leadership in industrial and economic thinking—all have an important place, but the business press and technical journals are in a unique position and have a unique opportunity. I believe that no organization of technical publications has come nearer to living up to this opportunity than the McGraw-Hill publications under the leadership of James H. McGraw.

"The thought that I have in mind is that your great group of journals can not only recognize and support sound industrial leadership; you can also initiate it. The field of your opportunity is practically limitless."

The scope of the meeting and the breadth of the discussion are indicated by some of the program features. Mr. McGraw in a notable address outlined conditions in industry and the methods whereby the business press can be of greater service. W. L. Batt, president of "SKF" industries, talked on creative selling, and P. L. Thompson, advertising director of the Western Electric Company, talked on the publisher's representative from the buyer's point of view. James H. McGraw, Jr., E. J. Mehren, Malcolm Muir and Mason Britton gave addresses on various aspects of sales service and business-buying habits. Editors and representatives of the McGraw-Hill Book Company were heard, and together with talks by representatives of the circulation department, there was presented a complete picture of the service rendered by the business press and of the big organization built up to give this service.

At the banquet on Friday night Julius Barnes, David Sarnoff, F. I. Kent and E. J. Mehren made excellent addresses. Mr. Barnes talked on international industrial conditions, David Sarnoff outlined the wonderful opportunities for development in American industry, Mr. Kent gave an intimate picture of the economic problems facing the world as a result of the war, and E. J. Mehren summed up modern ideals in the editorial and sales work of the business press.

A theater party and a visit to the various departments of the McGraw-Hill plant were other features of the meeting which went to make the event successful and fruitful.

Chicago Diversion Law Unlikely from This Congress

No legislation in the matter of water diversion from Lake Michigan at Chicago is expected at this session of Congress. Since the Supreme Court's decision the subject has come in for intensive study on each side of the Capitol, and it is becoming increasingly apparent that all the facts necessary to intelligent legislation are not available. For that reason it is anticipated that the War Department will issue a temporary permit continuing the status quo at Chicago. Congress probably will provide for the gathering of the necessary data.

The Supreme Court's decision is regarded as having had the effect of dissipating much of the murk which heretofore has befogged the situation. It is recognized as being a necessary step in the solution of the St. Lawrence problem. The logical next step, it is pointed out, is to initiate negotiations looking to the revision of the treaty of 1909, which does not preclude the diversion of 10,000 second-feet at Chicago. That treaty does, however, put Canada in a position where she has a right to demand equities, and the difficulties will not be great, it is believed, in determining what Chicago shall do to offset the damages caused by its use of water from the lake system.

In the matter of power alone none questions that the 10,000 second-feet diversion to the Mississippi Valley would, if allowed to go to the sea by the way of the St. Lawrence, constitute potential power to the extent of 300,000 hp. to Canada and 200,000 hp. on the American side.

Great Falls of Potomac Bill Unlikely to Go Through

While the action of the District of Columbia committee of the House of Representatives in reporting favorably on the Great Falls hydro-electric project places that legislation in a position where it may become a law at this session of Congress, it is believed that the opposition of majority leaders to a measure calling for the ultimate expenditure of $44,421,000 will prevent its passage in the House.

The committee in reporting favorably on the bill urges the immediate construction of the first unit of the project, which is the construction of a dam at Chain Bridge, a few miles above Washington, at a cost of $13,600,000. It is estimated that this dam alone would make possible the production of 415,000,000 kw.-hr. annually. The committee accepts an estimate that power could be produced at the Chain Bridge dam for 2 mills less than it is being produced for at the existing steam plant in Washington.

As amended in the House, the bill requires that the Federal Power Commission obtain guarantees for the disposal of the power before the work is begun. It is estimated that the Washington area will require 500,000,000 kw.-hr. of electricity in 1930 and 900,000,000 kw.-hr. in 1945. The committee also is encouraged by the fact that investment bankers have gone on record as to their willingness to enter into a long-term lease for the power. Another reason advanced for the passage of the bill is that the utilization of this great natural resource in the District of Columbia will set an example of high value to the states.

Details of Conowingo

Final Plans Are for Ten 40,000-Kva. Units, Six of Which Will Be in Initial Plant

IN CONNECTION with the award of the contract by the Susquehanna Power Company for the design and construction of the great hydro-electric plant on the Susquehanna River, 8 miles above Havre de Grace, at Conowingo, Md., which is to have an ultimate capacity of 360,000 kw., authenticated details of the contract requirements have been given out which differ somewhat from the particulars of the undertaking as published at the time that a license from the Federal Power Commission was procured. The details as indicated by the contract terms follow:

Ten 40,000-kva. vertical, directly connected units will be installed ultimately, six of which will be in the initial installation, and will operate at 90 per cent power factor, 13,200 volts, three-phase and 60 cycles. Electricity will probably be transmitted at 220,000 volts from a substation at Conowingo to Philadelphia. The transmission line will consist of two and ultimately three circuits.

The dam will be 4,500 ft. long and will give a net effective head of 85 ft., almost the entire fall of the river from the Holtwood (McCall's Ferry) water-power station to the sea level, a distance of 13½ miles. The reservoir will cover 8,000 acres and will flood a highway bridge at Conowingo as well as 15 miles of a branch of the Pennsylvania Railroad. A new highway bridge 4,000 ft. long, will be built below the dam.

The Conowingo station will ultimately develop nearly 65 per cent as much power as the present output of Niagara Falls and will be the largest single water-power plant built by private capital in this country. The estimated cost of the development, as previously stated, is $52,000,000. Considerable agitation has arisen in Maryland over the project, based on the intention to utilize the energy mainly in other states and its possible sale at rates lower than prevail in Baltimore. The Attorney-General of the state has sustained the Maryland Public Service Commission in its claim of complete jurisdiction over the plant.

Western Inspectors Discuss Code

Louisville Meeting Takes up Many Rules as Embodied in State and National Laws—International Association of Inspectors Is Favored

THE keen interest of the electrical industry as a whole in the subject of "special rules" was made manifest by the large number who attended the twentieth annual convention of the Western Association of Electrical Inspectors, held at Louisville January 27 to 29.

G. E. Kreucke of Milwaukee, Wis., called especial attention to the need for the application of more safety features in connection with the installation and operation of electric hoists; H. J. Clark, Oklahoma City, advocated issuing instructions to the public concerning the safe operation and maintenance of electrical equipment, and F. H. Moore, Indianapolis, expressed some clear-cut ideas in connection with architects' specifications. John W. Kelly, Jr., Camden, N. J., in discussing signal systems, asked that all arguments be presented in time to be submitted to a public hearing to be held on this subject.

Electric Ranges and Power Factor

Power-factor requirements for electric range installations were the subject of an interesting paper prepared by F. A. Cambridge, Winnipeg, Man., and read by V. H. Tousley. This paper covered the recent installation of three thousand electric ranges in certain sections of Winnipeg. It is probably the first extensive study of this particular subject and will be the basis for further investigation.

E. O. Evertz, Columbus, Ohio, in a report on public safety, recommended that all live metal parts of a wiring system be inclosed. On account of recent disastrous accidents in public buildings it was recommended that a compulsory rule be adopted requiring adequate exit lights in all buildings where transients are housed. Frank R. Daniels, Milwaukee, said that good results in safety are being secured in Milwaukee through the Boy Scout organizations.

A lively discussion took place on the report of the committee to investigate branch-circuit fuses, presented by William P. Briggs, New Bedford, Mass., no final disposition of the matter being made. Chairman F. R. Daniel, Milwaukee, of the committee on diagrams submitted the report of that committee in the form of three comprehensive diagrams and asked that members communicate with him relative to changes. R. C. Loughead of Detroit discussed the progress made covering work dealing with power houses and substations. The insurance committee of the National Electric Light Association is co-operating in this work.

Ben W. Clark, Detroit, emphasized the importance of safe elevator wiring. Farm-lighting systems were discussed by Israel Lovett, Omaha, who laid especial stress on the economic value of such installations to the farmer. The need for lightning arresters and also the need for educating the public as to their hazards was dealt with.

A. McLachlan, secretary Square "D" Company, Detroit, made an address on safe electrical installations that aroused much interest. A recommendation was made that service fuses be made inaccessible to users when in conjunction with a sealed service switch.

Much interest was shown in a paragraph in the report of the executive committee of the association, presented by Victor H. Tousley, which dealt with a proposed international association of electrical inspectors. The convention passed a resolution favoring the plan and inviting the Pacific association and the various Eastern associations to help in the formation of such an association.

State and National Codes

Thursday morning's program was devoted principally to discussion of the state electrical code, which was dealt with from the viewpoint of the state by John A. Hoeveler, electrical engineer with the Industrial Commission at Madison, who maintained that the state code should go more into safety measures than the National Electrical Code. Conditions have been greatly improved by the examination and licensing of electricians by cities and towns, but sub-standard work is still done in outside districts. The real solution to the problem, as outlined by Mr. Hoeveler, is licensing by the state commission.

C. A. Bates, Bridgeport, Conn., discussed the subject from the viewpoint of the manufacturers, advocating uniform rules in all states and municipalities in harmony with the national rules. Speaking from the public service company's viewpoint, Alexander Maxwell, N. E. L. A., said that order will come if national standards are used by states and municipalities. A. P. Good, Chicago, outlined in detail the methods employed by the Commonwealth Edison Company when it becomes aware that any installation is dangerously non-standard.

On Thursday afternoon the report of the committee on the National Electrical Code, read by K. W. Adkins, evoked lively discussion covering the prohibition of use of wood molding and a detailed investigation of metal-armored cable. There was also considerable discussion as to the advisability of separating the rules for conduit and armored cable.

Proposed rules for use in architects' specifications included one to make it mandatory for open runs of wires and conductors to be in rigid metal conduit and one for use in determining the size of mains, namely: Residential, 6 amp. at 110 volts, 3 amp. at 220 volts; all other lighting circuits, 10 amp. at 110 volts, 5 amp. at 220 volts. The committee recommended also that the rules should be changed to require rigid metal conduit for signs from the cabinet to the interior of the sign, for outline wiring from the cut-out to the interior of the metal trough and for motors from the controlling switch up to the motor.

Officers elected were: President, John A. Hoeveler, Madison, Wis.; first vice-president, James S. Mahan, Chicago; second vice-president, John W. Kelly, Jr., Camden, N. J.; secretary and treasurer, W. S. Boyd, Chicago.

N. E. L. A. Committee Tells of Refrigeration Research

At a meeting in New York this week of the electric refrigeration committee of the National Electric Light Association the chairman, T. I. Jones of the Brooklyn Edison Company, who is also chairman of the corresponding committee of the Association of Edison Illuminating Companies, reported that the committee is carrying out a series of tests on the domestic refrigerating machines in actual use in homes and hospitals. This work is in charge of W. E. Clement, new-business manager of the New Orleans Public Service, Inc., who has received five thousand records already. I. Fisher of San Francisco, E. W. Lloyd of Chicago, A. D. McLay of Detroit, G. E. Miller of Cleveland, R. H. Stillman of Baltimore and R. R. Young of Newark are also making researches and collecting information along different lines. The purpose of the committee is to recommend machines for commercial and domestic use. The need for public education was emphasized, and a discussion on the motor situation took place. The committee will make a joint report to the N. E. L. A. and the Edison association.

Low Water Curtails Output in Maine and New Brunswick

Low water is seriously hampering power production for Maine's industries. The flow of the Saco and Kennebec Rivers is only half normal. The Androscoggin, because of its better storage facilities, reports a somewhat better situation. The Central Maine Power Company, which normally generates power almost entirely from its hydro-electric plants, is taking 45 per cent of its power from steam plants at Lewiston and Farmingdale. The Bangor Railway & Electric Company reports more capacity at the present time because of a large storage basin on the Union River at Ellsworth and is producing sufficiently for stations on the Penobscot. The Union River, notwithstanding, is very low.

A power shortage has hit many towns in northern New Brunswick. These towns are served from the hydro-electric plant at Aroostook Falls. Me., but as a result of the long drought and unusually cold weather, which has frozen lakes and streams to the bottom, sufficient power from Aroostook is no longer available. Service in all the towns is greatly curtailed.

Reported slightly higher water in the Connecticut River has temporarily averted the threatened necessity of draining the canals of the Holyoke Water Power Company at Holyoke, Mass. If this should happen, mills depending on this source for their power would be forced to close down temporarily.

Economy of Automatic Substation Equipment Upheld

Economy in operating labor and reduction in time required for placing in service and shutting down machines are two important factors contributing to the rapid growth in the use of automatic substation equipment. This was the opinion expressed at the joint meeting of the Western Society of Engineers, Chicago Section of the American Institute of Electrical Engineers and Chicago Section of the Association of Iron and Steel Electrical Engineers held in Chicago on Monday, Jan. 26.

"Automatic Substations in Steel Mills" was the subject of a paper presented by G. P. Wilson, general engineer steelmill section Westinghouse Electric & Manufacturing Company. Features of present-day automatic substation equipment, as described by Mr. Wilson, which result in economy and better service are rapid starting of machines under full protection at every step, elimination of delay and danger from "feeling out" required by manual operation, ability to discriminate between short circuits and overload, power-factor correction, protection during starting and running, varying temperature protection, phase-balance protection, and the indicator for locating cause of "locking out of machines." Mr. Wilson said the recognition of the inherent advantages of automatic substation equipment had resulted in sales reaching those of manually operated equipment.

Contractors Discuss Making Business Profitable

About 150 electrical contractors and dealers from all parts of Wisconsin attended the eighth annual convention of the Wisconsin State Association of Electrical Contractors and Dealers, held at Milwaukee on January 28, 29 and 30, which was considered one of the most spirited and successful meetings yet held.

Addresses were given by L. W. Burch, Madison, chairman of the meeting; by L. G. Ross, Superior; by B. L. Burdick, Milwaukee, on "Electrical Contracting Resources and Ways," and by R. J. Nickles, Madison, on "Establishment of Policies for Strengthening Our Association," each address being followed by a general discussion of the points brought out.

L. W. Davis, general manager of the Association of Electragists International, New York City, made an instructive address on "Will You Make Your Business Profitable?" He urged electrical contractors to discard the usually unprofitable practice of contracting for jobs where highly competitive conditions exist. He touched also on the turnover of the electrical supply business compared with other businesses and appealed for full cooperation from electrical contractors in sending in their selling and buying experiences to be used for purposes of study and disseminated for general benefit. He condemned sessions behind closed doors.

A measure was indorsed for presentation to the Legislature requiring electricians to have a state license and contractors a permit. L. W. Burch, Madison, was elected as president, to serve also as secretary pending the selection of a paid secretary, and J. L. Acker, Sheboygan, was made treasurer.

Loveland, Col., to Get Private Plant for $113,350

A valuation of $113,350 has been fixed by a jury in the District Court at Fort Collins, Col., on the property of the Public Service Company of Colorado condemned by the city of Loveland for use in connection with the power plant now being built by that municipality. The jury made an additional award of $2,877 for damages to company property. The Public Service Company set up a valuation of $160,000, while the city contended for a valuation of $83,000. Future action of the company is undecided.

Colorado Springs Completes Purchase of Private Plant

Colorado Springs, which last year paid the Colorado Springs Light, Heat & Power Company $600,000 for its plant, following the voters' decision in favor of municipal ownership, has come to an agreement to pay $250,000 for the company's distribution system and will serve the small independent communities in the Pike's Peak region. This agreement marks the final disruption of the company's electric system, the steam-heating system already having been closed down because of financial losses. The city is building a half-million-dollar steam plant as an auxiliary to the hydro-electric plant at Manitou.

Briefer News

Associated Gas & Electric Buys Connecticut Company. — The Ridgefield (Conn.) Electric Company, hitherto locally controlled, has been purchased by the Associated Gas & Electric Company of New York, which has no other Connecticut properties. The Ridgefield company buys its energy from the Connecticut Light & Power Company.

New York Electrical League Elects Officers.—The following were elected as officers of the New York Electrical League last week: President, Walter J. Drury; first vice-president, Albert Goldman; second vice-president, S. E. Kimball; secretary, D. T. Brown; treasurer, L. I. Strauss.

Los Angeles Seeks to Condemn Southern Edison Lines in Annexed District.—Proceedings providing for the purchase or condemnation by the city of Los Angeles of Southern California Edison Company lines in sections annexed to the city since the Edison purchase in 1922 have been authorized by the Public Service Board of the city on the recommendation of Bureau of Power and Light engineers, who said that purchase of the Edison lines, now serving widely scattered sections within the city limits, and the consolidation of these lines with the municipal electric system would eliminate waste resulting from duplication. The company denied that it had had any negotiations with the city along such lines. The city bases its authority on the bond issue voted last year for Power Bureau purposes.

Central Iowa Company Buys Grundy Center Plant.—The Grundy Center (Iowa) Electric Company has been sold by J. B. Calderwood to the Central Iowa Power & Light Company, which is controlled by the American Gas Company of Philadelphia. The consideration is said to have been $95,000. Energy will be derived soon from Waterloo, but the local plant will be maintained as a standby.

Utilities Power & Light Corporation Has Plans for Expansion.—Extensive interconnection to join its plants in Iowa, Wisconsin and Minnesota is planned for 1925 by the Utilities Power & Light Corporation. Dubuque, Iowa, will be the center of this work, and the capacity of the East Eighth Street generating plant will be doubled, according to C. E. Dove, general manager of the Dubuque Electric Company.

Another Link in North Atlantic Interconnection. — Completing work which has been under way since June, 1924, the Carlisle hydro-electric power interests in northern New York, including plants on streams in Jefferson, Lewis and St. Lawrence Counties, were on January 23 tied into the interconnected systems of companies whose lines extend from Detroit to Boston and as far south as Baltimore. The connection was made in the town of Albion, N. Y.

Interconnection May Be Made Between Staten Island and Upstate Counties.—Plans of the New York-New Jersey Superpower Connecting Corporation to connect electric plants in Rockland, Orange, Otsego and Herkimer Counties, N. Y., with plants on Staten Island, in New York Bay, through the use of the lines of the Public Service Electric & Gas Company in New Jersey, were indicated in testimony given before the New Jersey Board of Public Utility Commissioners last week in the course of an application for a stock issue. The plants in question are controlled by the J. G. White Management Corporation, New York.

Niagara Falls Power Acquires Power Rights in Gorge.—The Niagara Gorge railroad, said to be the best known scenic line in the United States, was taken over by the new owner, the Niagara Falls Power Company, during the last week in January. The company has announced that for the present, or until it becomes necessary to start the power development in the lower river, the Gorge route railway service will be continued. By this purchase, made several months ago and recently approved by the Public Service Commission, power rights are acquired for a distance of several miles along the east bank of the river from Niagara Falls to Lewiston, including

that part along the famous Whirlpool rapids. This will enable the company to use a second time water which it uses in power development above Niagara Falls.

How Boston Edison Capitalized the Eclipse.—That Boston was outside the line of totality in the eclipse of the sun

"On Monday a total eclipse of the sun was visible in the town. The commencement and duration answered very nearly to the calculations in the books. It unveiled very general observation and must have excited the most sublime fenfations. The atmofphere was unufually clear and not a cloud to be feen. The darkneſs came in very fuddenly and to fuch a degree that the countenances of perſons well known could not be diſcerned at twelve to fourteen feet diſtance in the ſtreets. The continuance of darkneſs was about four minutes and a half."
From The Independent Chronicle Boston, June 19, 1806
AGAIN a total eclipse — after one hundred and nineteen years. The recurrence of this eclipse will be studied by scientists and remarked on by all, but to you there will come no inconvenience.
When the sun ceases to do its work, there immediately comes a demand for light. Turbines are in readiness. Steam boilers are stoked. The generating of more current is under way.
EDISON LIGHT of BOSTON
The Friendly Glow

did not prevent the Edison Electric Illuminating Company of that city from seizing the occasion to emphasize the availability of its service at all times. By means of the accompanying newspaper advertisement on that morning it contrasted in a striking and historically interesting manner the conditions prevailing during the total eclipse of the sun more than a century ago with the availability of central-station service today as a dissipator of darkness.

Utah Power & Light Takes Over Tooele Property.—The Utah Power & Light Company, Salt Lake City, has taken over for operation the property of the Clark Electric Company, which formerly had its main office at Tooele, Utah, and of which W. A. Clark, New York, was president. The territory served by the latter company includes the towns of Tooele, Stockton, Ophir and Grantsville and is now made a part of the Utah Power & Light Company's Bingham division.

Texas Mayors Oppose Special Municipal Boards for Public Utilities.—Mayors of a number of cities of Texas have announced their opposition to a bill which has been introduced in the Legislature by Senator J. D. Parnell providing that municipally owned public utilities shall be placed under a special board of management the members of which would be elected by the voters. The operation of the municipal plants so controlled would be separate from the operation of the other business of the city. The plan proposed is the same as that now in force in Waco, Senator Parnell said. The Mayor of Dallas, one of the opponents, says the bill is wholly revolutionary and disturbs the entire machinery set up under the city charter.

Small Power Field to Be Defined at Holyoke, Mass.—Mayor J. F. Cronin of Holyoke, Mass., has applied to the courts for an injunction to restrain the Holyoke Water Power Company from selling electricity for lighting and in blocks of less than 100 hp., contending that such practice violates the legal rights of the city lighting department. The protest arises from a contract between the power company and William Skinner & Sons which is reported to afford the latter an opportunity to utilize by machinery of its own installation some of the purchased energy for lighting purposes.

Price of Kewanee (Ill.) Franchise and City Properties in Dispute. — A cash offer of $125,000 made to the city of Kewanee, by the Kewanee (Ill.) Public Service Company, in settlement for certain city properties and rights on the streets, as a factor carrying out the ordinance under which the company is now operating its power plant and street-car system, has been rejected by the City Council, which contends that the municipal lighting plant started by the city, with the unpaid contracts, real estate and interest, cost about $171,000 and that the offer is therefore inadequate.

New Transmission Line Between Springfield, Ill., and Peoria Ready.—The 132,000-volt transmission line connecting the system of the Central Illinois Light Company at Peoria with the Illinois Power Company's lines at Springfield is about ready to go into service. This 78-mile line is almost a direct one between Springfield and Peoria, deviating at three points. The Illinois Light & Power Corporation has contracted to purchase power from the Illinois Power Company for use in Decatur and will be supplied over a steel-tower line to be built soon. The four-million-dollar plant of the Illinois Electric Power Company at East Peoria will be in operation about March 1. This initial installation represents about 40 per cent of the ultimate planned and includes two turbo-generators each capable of developing about 35,000 kva. Pulverized coal will be used.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, January 3, page 76.]

American Institute of Electrical Engineers—New York, Feb. 9-12; St. Louis, April 13-17; Saratoga, N. Y., June 22-26. F. L. Hutchinson, 33 West 39th St., New York.

New Mexico Electrical Association—Albuquerque, N. M., Feb. 16-18. Bernard L. Wiles, Albuquerque Gas & Electric Company, Albuquerque, N. M.

Wisconsin Chapter of Electrical Inspectors—Pfister Hotel, Milwaukee, Feb. 17-19. A. C. Schultz, Milwaukee.

Oklahoma Utilities Association—Oklahoma City, March 10-12. E. F. McKay, Oklahoma City.

Illinois State Electric Association—Hotel Sherman, Chicago, March 18-19. R. V. Prather, Illinois Mine Workers' Bldg., Springfield, Ill.

Floods in South Georgia Put Hydro Plants Out of Operation.—South Georgia was visited by unprecedented high waters in the week ended January 24, which completely put the hydro-electric plants of that section out of operation. The main Flint River plant of the Georgia-Alabama Power Company at Albany was built for a maximum 32-ft. rise, and the flood crested at 36.6 ft. No serious damage was done to the property other than flooding of

the Muckafoonee plant, as shown in the illustration, and the flooding of the basement of the Flint River plant, completely submerging switching equipment and current coils. A 600-ft. section of the roadway from the main land to the plant was washed out, as was a section of embankment between the creek plant and the steam auxiliary plant. It is estimated that the total damage will amount to approximately $75,000. In addition to the difficulties experienced in Georgia a portion of the earth embankment west of the Bates dam in Alabama was washed away.

No Power to Be Derived by Grand Forks, N. D., from Red River.—E. H. Morris, chief engineer of the Board of Railroad Commissioners of North Dakota, informs the ELECTRICAL WORLD, apropos of a recent item implying that the city of Grand Forks, N. D., contemplated damming the Red River of the North for power purposes, that the Red River does not have sufficient flow or fall for power purposes at Grand Forks. The projected dam is for waterworks, not for power purposes.

City Meeting at Norwich, Conn., Opposes Further Bids for Municipal Power Plant.—One thousand citizens gathered in city meeting at Norwich, Conn., recently in response to a call to "abrogate forthwith all arrangements or commitments, either secret or otherwise, looking for the sale or lease" of the Norwich municipal lighting plant. A resolution "enjoining the Mayor and Common Council from any further entertainment of bids or proposals that would in any way contemplate the sale or lease" of the plant was overwhelmingly adopted. Construing this resolution to mean the closing of bids, two bills were presented in the Connecticut General Assembly by the city—one authorizing the sale of the plant to A. E. Fitkin & Company of New York and the other its sale to the Eastern Connecticut Power Company, represented by Bodell & Company. The bills were referred to committees.

Men of the Industry

Stone & Webster Managerial Changes

Howard C. Foss has assumed active supervision of the affairs of the Savannah (Ga.) Electric & Power Company as president, thus establishing a local president in charge of the operations of another of the large companies under Stone & Webster executive management. Because of the additional responsibilities assumed by Mr. Foss, his duties as Southeastern district manager for the Stone & Webster companies will be assumed by Alba H. Warren, now manager of the El Paso (Tex.) Electric Railway Company. The Southeastern district office will remain in Savannah, and Mr. Warren will take up his work there within a few weeks.

Robert C. Brooks, formerly manager of the Savannah Electric & Power Company, has been appointed manager of the Pawtucket (R. I.) division of the Blackstone Valley Gas & Electric Company.

Tom P. Walker, formerly manager of the Baton Rouge (La.) Electric Company, has been appointed manager of the El Paso Electric Railway Company. J. F. McLaughlin, general superintendent of the El Paso Electric Railway Company, is to succeed Mr. Walker as manager of the Baton Rouge Electric Company.

C. R. Witham, formerly connected with the distribution engineering department of the Consumers Power Company, Jackson, Mich., has been made district engineer to succeed P. H. Wheeler, recently transferred to Mason.

Harry M. Rankin, formerly associated with the General Electric Company as special engineer, has joined the engineering and operating staffs of the Georgia Railway & Power Company. Mr. Rankin is a graduate of the University of Michigan and is well known in electrical engineering circles.

W. W. Muckenfuss has been elected secretary of the Carolina Light & Power Company, Aiken, S. C. The utility was recently taken over by the J. G. White Management Corporation of New York. Mr. Muckenfuss is also a member of the board of directors.

John T. Naylon, formerly manager of the Oklahoma Gas & Electric Company at El Reno, has been promoted to the position of manager of the company's new southwestern division. Mr. Naylon's rise in the company has been rapid. He joined its ranks six years ago, going from Detroit, where he was efficiency engineer of the Henry Ford company. He began work with the Oklahoma Gas & Electric Company as efficiency engineer in the gas department and was rapidly promoted. Creation of the southwestern division, embracing Elk City, Clinton and the El Reno properties, means much for that section of the state as it doubtless forecasts much greater development and extension of electric facilities to western and southwestern Oklahoma.

Harry L. Brown, editor of the *Electric Railway Journal* and some years ago an assistant editor on the staff of the ELECTRICAL WORLD, both McGraw-Hill publications, resigned from the former post on February 1 to become an executive of the Ohio Brass Company, Mansfield, Ohio. His association with the McGraw-Hill Company covered a period of ten years and followed engineering work with the Aurora, Elgin & Chicago Railroad and the Chicago Telephone Company. Mr. Brown is a graduate of the University of Michigan in electrical engineering.

Dwight Ware has been appointed manager of the Puget Sound Power & Light Securities Company, Seattle, organized two years ago for dealing in the securities of the Puget Sound Power & Light Company. Since the formation of the securities company Mr. Ware has been assistant manager, serving in that capacity until the recent death of Frank Dabney, manager.

Roy W. Mathisson, formerly chief clerk in the auditor's office of the Birmingham Electric Company, has been appointed auditor of the Knoxville (Tenn.) Power & Light Company. Previous to his association with the Birmingham utility Mr. Mathisson spent two years as general bookkeeper in the auditor's office of the Houston (Tex.) Lighting & Power Company. Though a native of New York, he received his education at the public schools and high school in Birmingham and at the Alabama Polytechnic Institute.

George C. Sawyer, for the past eleven years district manager at Yakima, Wash., for the Pacific Power & Light Company, Portland, Ore., has been promoted to the position of sales manager of that company with headquarters at Portland. He entered the employ of the Pacific Power & Light Company as meter engineer with headquarters at Walla Walla, Wash., in 1910 and three years later was appointed to the position of district manager at Yakima, where he remained until his recent promotion. In his new position he will have charge of matters pertaining to new business of all kinds, principally power sales.

Henry C. Anderson, for the past three years assistant Western editor of the ELECTRICAL WORLD at Chicago, has been transferred to the business staff of this paper in New York. He joined the editorial staff in 1921 after spending a year studying power-plant engineering at the graduate school of Yale University, from which he took a degree in electrical engineering in 1920. The experience he obtained while traveling through ten states in the Middle West, visiting utility properties and executives and learning about utility problems, practices and experiences, will assist him materially in his new work on the business staff. Mr. Anderson is an associate member of the A. I. E. E. and a member of the Electric Club of Chicago and the Yale Engineering Association.

N. McD. Crawford Resigns

Norman McD. Crawford, vice-president and treasurer of the Columbus (Ohio) Railway, Power & Light Company, has resigned, effective at the convenience of the board of directors, but not later than March 1. Mr. Crawford has been connected with the Columbus utility since 1916, when he became representative there of the E. W. Clark & Company Management Corporation. Not long after he was elected vice-president, retaining that office when several years ago the control of the company passed into new hands. Mr. Crawford is well known in the East, having been formerly identified in an executive capacity with the Hartford Street Railway, the Mahoning & Shenango Railway & Light Company, the Reading Transit & Light Company and the Metropolitan Electric Company. Mr. Crawford has no business plans for the future, intending to retire from active work.

Obituary

Colonel William S. Gentry, former president of the Southern Bell Telephone & Telegraph Company, died at his home in Atlanta on January 11, following a prolonged illness. Colonel Gentry retired at the age of sixty-five, after forty-six years in the employ of the telephone and allied industries, having filled nearly every position in the Southern Bell Company where practical or technical knowledge was required. He was one of the first officials of public utility corporations to favor the appointment of state regulating commissions. He was eighty years old.

Lyman Clark of the publicity department of the General Electric Company at Schenectady died December 17, following an operation for acute appendicitis. Mr. Clark entered the employ of the General Electric Company in 1892. Following a course in the testing department at the Lynn works, he entered the commercial field and was attached to the Washington and Pittsburgh offices of the company before going to Schenectady in 1920. Mr. Clark was fifty-one years of age.

Arthur H. Brown, for many years a consulting electrical engineer for the Thomson-Houston Company, died January 27 at his home in Lynn, Mass. Mr. Brown was born in Lynn and educated in the public schools there. He was connected with the electrical business of the city for more than twenty-five years, retiring about five years ago.

Charles H. Parker, for many years superintendent of the generating department of the Edison Electric Illuminating Company of Boston, died at his home in Brookline, Mass., January 28 after a long illness. Mr. Parker was born fifty-one years ago at Hong Kong, China, was graduated in mechanical engineering from the Massachusetts Institute of Technology in 1895 and served in the United States Navy during the Spanish-American War. His entire professional life had been identified with the Boston company.

Recent Court Decisions

Transcript of Commission Record Must Be in Legal Form.—The Supreme Court of Idaho in McElroy vs. Boise Valley Traction Company, an appeal from a finding of the Idaho Public Utilities Commission, struck from the case the transcript of the commission's proceedings as not being in the form required by law. This leaving nothing before the court for consideration, the appeal was dismissed and costs awarded to the respondent. (230 Pac. 1012.)*

Owner of Wires and Electric Company as Licensee May Be Sued Jointly for Damages.—The Court of Appeals of Georgia has held, in McKenzie vs. Foy & Shemwell and Georgia-Alabama Power Company, that the plaintiff could sue the defendants jointly for damages because of the loss of two mules killed by falling wires owned by the firm named but leased by it to the power company for the transmission of electricity. It was alleged that because of improper construction and maintenance the wires came into contact, one of them being heavily charged. Both defendants, the Court of Appeals held, were culpably negligent in failing to inspect and maintain the wires properly, and they were properly joined in the suit. The lower court erred in finding otherwise. (125 S. E. 517.)

Tennessee Merger Again Upheld.—The Supreme Court of Tennessee has affirmed the ruling of the Chancellor of Davidson County holding legal the merger effected between the Nashville Railway & Light Company, the Chattanooga Railway & Light Company, the Tennessee Power Company and the Chattanooga & Tennessee River Power Company into the Tennessee Electric Power Company, which was attacked by the Attorney-General of Tennessee as a violation of the anti-trust laws of the state. The Supreme Court was of the opinion that the statute creating the public utilities commission and other statutes regulating public utilities companies have the effect of expressly authorizing monopoly in the production and distribution of electric power and service under the control of the Public Utilities Commission, which commission had approved the combination under attack in the state. The Supreme Court held, therefore, that the anti-trust laws forbidding combinations in restraint of trade do not apply to the control of electric power.

Customer Alleged to Be Delinquent and Sued by Company Cannot Recover Damages on Cross-Complaint. — The North Pacific Public Service Company sued a customer named Carter for payment for electricity alleged to have been used by him but not recorded on his meter. This suit was brought subsequent to the disconnection by the company of the customer's service on the charge that the meter had been tampered with. The defendant filed a cross-bill for damages because of discontinuance of service and denied that he had tampered with the meter. The trial court found against the company on the ground that its allegations were unfounded and also awarded to the defendant the damages sought. The Supreme Court of the State of Washington has, on appeal, sustained the finding against the company but has disallowed the damages on the ground that damages for breach of contract are only such as arise in natural course or were contemplated when the contract was entered into. (230 Pac. 849.)

Depreciation of Market Value of Hotel Not an Element in Estimation of Loss from Deprivation of Electricity.—In Bastien vs. Marienville Glass Company, an action for damages for failure to continue furnishing electricity to plaintiff's hotel as long as defendant's company continued in business, the contract being personal and terminable, damages, the Supreme Court of Pennsylvania held, were necessarily restricted to loss from deprivation of energy for a certain period, and evidence of resulting depreciation in the market value of hotel and cost of installing a separate plant, with expense of operating it in the future, was therefore incompetent. (126 At. 798.)

Placing Wire Cable Near Electric Line Contributory Negligence.—Where well drillers employed by a third person placed equipment so that wire cable would be drawn in close proximity to defendant's electric power line, contributory neglience warranted the court in entering nonsuits in actions for injuries and deaths from electrocution. This was the finding of the Supreme Court of Pennsylvania in Aljoe vs. Penn Central Light & Power Company. The presumption that deceased men used due care does not apply where deaths could only have resulted from their bringing wire cable in close proximity to electric power line. (126 At. 759.)

Placing Uninsulated Wire in Tree Branches Adjoining School Playground Is Negligence.—Ten thousand dollars' damages were granted by a jury for the severe and permanent injury of a boy who took hold of a wire which other boys had in sport thrown over an uninsulated feed wire passing through a tree adjoining a school playground. This verdict has been sustained by the Supreme Court of Mississippi (Jones vs. Laurel Light & Railway Company), the court holding that the company was guilty of negligence in so placing and maintaining its feed wire and that this negligence was a contributing proximate cause of the injury. The amount, the court further held, was not excessive. (102 So. 1.)

Negligence to Sustain Dangerous Wire Anywhere Where Persons May Reasonably Be Expected to Touch It.—In Oil Belt Power Company vs. Touchstone damages of $10,000 were awarded for the death of a boy who went swimming in a tank over which the company had strung uninsulated highly charged wires and came into contact with them. Sustaining the judgment, the Court of Civil Appeals of Texas held that it is negligence to maintain such wires in any place where persons may reasonably be expected to come into contact with them. The fact that the boy had no permission from the lessee of the tank to go swimming in it but only to go on the runway to look for cattle was held to be no defense. Contributory negligence was held not to be sustained, the victim having had little opportunity to know of the danger from the wires and no warnings having been posted. An argument of counsel based on the theory that death was caused by coming near the wire and not into contact therewith did not constitute a reversible error. (266 S. W. 432.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Reduction in Rates Fixed by Commission but Found to Be Too High Will Not Be Made Retroactive.—In evaluating the property of the Hughes Electric Company of Bismarck, N. D., the Board of Railroad Commissioners of North Dakota refused to make retroactive a reduction in rates held to be unreasonable, pointing out that a utility cannot make up a deficit by means either of retroactive or excessive future rates and that a rule must work both ways. The commission said on this point: "In prescribing the schedule of rates contained in the order in the original case, which rates are now alleged to be excessive, the commission followed the statute as we then construed it. The value of the property was determined, the operating revenues and expenses were estimated for the future by giving consideration to all relevant facts. Rates were being made for the future and not for the past, and in this, as in all similar proceedings, the operating results for the future were to a considerable extent estimated. We may reasonably assume under ordinary circumstances that the revenues for the year ahead will compare favorably with the preceding year. In growing communities it is reasonable to assume that there will be a normal increase in electric consumption ranging from 2 per cent to 10 per cent. These are assumptions and estimates. While operating revenues and expenses may be estimated with a reasonable degree of accuracy, a different result may be obtained from that anticipated at the time of the inquiry. In the original case the commission held that a return of 8 per cent upon the money honestly and prudently invested in the utility's property was reasonable and rates were established which, in the opinion of the commission, would provide for operating expenses and a reasonable return upon the investment. No guarantee of a return was made, and if the rates yielded less than a reasonable return, the utility could not make up a deficit by charging excessive rates in the future, nor can the utility apply for an increase and make the rates retroactive. A rule to be reasonable must work both ways."

Manufacturing and Markets

Proposed Wiring Method

National Electrical Code Committee Hears Arguments Pro and Con—Will Report February 17

PUBLIC hearings called by article committee No. 5, wiring methods, to consider a proposed new wiring method for open or concealed work as now covered by Sections 501 and 502 of the National Electrical Code have just been concluded. The first meeting was called at Louisville, Ky., on Friday, January 30, at the close of the meeting of the Western Association of Electrical Inspectors. There were about 165 people in attendance. The second meeting took place in New York City on February 2 and about seventy people were present.

In both meetings members of the committee listened to arguments in support of and against the proposed new wiring methods. The views of several electrical inspectors were also heard at both meetings. The committee will report to the sectional electrical committee meeting to be held in New York City on February 17, 18 and 19. It is expected that at this time the proposed change will either be accepted or rejected. The proposed changes in the code will approve the use of "Romex," a new twin-conductor cable manufactured by the Rome Wire Company, Rome, N. Y.

C. W. Abbott, engineer of the Rome Wire Company, speaking at Louisville in favor of the proposed change in code, gave the reasons for the development of this cable and pointed out the need for material which would produce economies and at the same time safety and would replace knob-and-tube and fished construction where flexible tubing is used. Mr. Abbott explained that his company was not trying to monopolize the production of this material but is ready and willing to license other manufacturers to make the material upon a reasonable basis. The material might be either good or bad, but his company felt sure that the Underwriters' Laboratories were entirely competent to determine the value of the material and that the Rome Wire Company is seeking only a revision of the code, Rule 5, to permit an approved material of this nature to be used.

Several Hundred Trial Installations Have Been Made

Criticism as well as commendation of the material was obtained from the large number of inspectors who had remained over from the Western Association of Electrical Inspectors' convention to attend this meeting and who had allowed and supervised several hundred trial installations throughout the country. Farley Osgood, president of the American Institute of Electrical Engineers, talked upon the fundamentals of the question and correct reckoning. He called attention to the fact that the technical investigators were the laboratories. He also thought that the National Fire Protection Association should see that the code does not go too far.

H. A. Calderwood, National Metal Moulding Company, Pittsburgh, spoke against the proposed change in the code and the approval of any material of the nature under consideration. He outlined the evolution of wiring installations from the time of wood cleats up to the present time. He mentioned that there were certain inaccuracies in statements made about Romex cable concerning its liability to mechanical injury and its combustibility and susceptibility to injury by rodents. A. M. Ferry, representing the Porcelain Manufacturers' Association, outlined several points in contending that the code be not changed to allow the use of the proposed non-metallic cable.

Among these were: That the code represents forty years' experience, that he doubted the accuracy of reported quality of the product, that the claimed economy is not present, that it seems impossible wires separated 5 in. and 1 in. from the surface wired over have higher dielectric strength than wires separated only ¼ in., that it is impossible for the patentee to govern a licensee when faced with competition from a cheap substitute, and that approval would lower code standards and prestige.

Simplification in Line Hardware

More than One Hundred Varieties of High-Voltage Insulator Pins—Variation in Cross-Arm Dimension Specifications and Insulators Chief Factor in Situation

BY L. J. KIRBY
Sales Engineer Electric Service Supplies Company, Chicago

FOR the sake of simplicity the following discussion is confined entirely to "insulator pins" or "truss pins" in fabricated-metal construction for use on 33-kv. to 66-kv. lines.

To meet the demand for insulator pins in this field manufacturers are now required to catalog and carry in stock greater or less quantities of pins in more than one hundred different styles, patterns and finishes. The thing which brings gray hair to the distributor of these products is the imperative demands that are suddenly thrust upon him following the absorption of some independent power systems by a larger operating company. When such transactions are consummated there is an immediate demand for the building of tying-in lines or extension of distribution lines to trunk lines, with a limited time in which to get such lines into service.

If the engineers for the new operating company specifies the same style and size of pin as was previously used for the same line voltage, the manufacturer or distributor is very likely to supply a reasonable quantity from stock. If, however, the type of insulator pin chosen for the new construction is different from the popular styles carried in the manufacturer's stock, it entails putting special rush orders through the factory — wasting time and money and the expense of express transportation to the purchaser. When it is appreciated that, although the manufacturer may stock ten or more of the most popular sizes, the purchaser may choose one out of a hundred sizes and styles, it will be seen that the opportunity for the selection of a style not backed by ample stock is very great. A satisfactory solution of this problem would be of great importance to the purchaser of this equipment as well as to the manufacturer, and a study of the factors responsible for the present condition may serve to indicate a line of procedure that will make the solution possible.

The chief factors responsible for the present great variety in sizes and styles of insulator pins are the variation in specifications for the dimensions of the cross-arm upon which the insulator and pin as a unit are mounted and the design of the insulator. The first factor is of far greater importance than the second.

In wooden cross-arms there are four well-recognized standard sizes, namely: 3¼ in. x 4¼ in., 3½ in. x 4½ in., 3¾ in. x 4¾ in. and 4 in. x 5 in.

Individual Ideas Prevail

In the high-tension field all four sizes of arms mentioned are used, according to the ideas of the individual engineering talent in the power company's organization. Some engineers consider the smallest size of arm adequate for their 33-kv. service, while others will consider using nothing less than a 4-in. by 5-in. arm for the same service. While the recognized standard arm may have a crown top, there are some who insist on using a flat type of arm on the ground that such arms maintain greater mechanical strength and do not lose their strength any earlier through water absorption. So far as wooden arms are concerned, therefore, the manufacturer must produce a pin that will be a compromise, fitting either flat or crown-type arms, if he desires to keep down the number of dies or patterns involved. If he desires to produce a pin that will span the arm and fit it, not only on top but on at least a portion of the sides, then he must multiply his dies or patterns by the number of sizes represented.

Departing from the wooden cross-arm support, there is encountered also the angle-iron support involved in the modern steel cross-arm supplied by various companies and as more widely used every day in steel-tower construction. Generally, either 3-in. or 4-in. angle iron is presented for the mounting surface of these pins, but the number of sizes of pins for angle-iron construction as well as wooden-arm construction is further influenced by the various heights required for the different line ratings of insulators.

Turning now to the insulator design, the manufacturer as a rule specifies in the cataloging of his product the minimum height of pin that should be used with the insulators for a given class of service. The height of pin specified by different manufacturers will, of course, vary, and the manufacturer cannot accept responsibility for the performance of his product if it is not mounted on pins of the height specified by him. Thus we find that while an 8-in. overall pin is generally adequate for a given service, there are some who want a 9-in. pin or even a higher pin for this same service. A rough survey of the field indicates that within the maximum of 66 kv. now recognized as permissible in pin-type construction it is necessary for pins to range from 5 in. to 13 in. in height, in steps of 1 in., arranged so as to meet all classes of insulators offered.

With consideration of the foregoing it will be seen that it is necessary to carry, as the writer's company does, a selection of fifty-five different pin patterns always kept in condition ready to be put into the sand at the malleable foundry. Competition forces the offering of various finishes and bolt sizes where separate parts are included in the design; hence, the cataloging of at least three styles for each pattern of pin, and in most cases six styles, becomes possible. Some manufacturers, therefore, catalog as high as 100 different styles in the high-voltage field, here understood to mean the range from 33 kv. to 66 kv.

Stock Requirements Present a Problem to Manufacturer

Records quickly show, of course, which types of pins move most rapidly, and perhaps all manufacturers and distributors of pins carry in stock greatest quantities of wooden cross-arm pins for 33-kv. service for the four recognized standard sizes of arms mentioned above, and along with them a comparable stock of pins for 3-in. angle-iron mounting for the same voltage service.

Of the less popularly used pin heights the manufacturer can only guess at what the customers are going to specify. Experience shows that certain types of pins for which a call has indicated popularity may be accumulated in the warehouse and remain there as long as five years, at which time the distributor is ready to write them off at a dead loss and scrap them, when he will be suddenly favored with an order for not only that stock but perhaps twice as many as he has, because some user on discovering them listed in the catalog finds that they fit exactly his special requirements at the moment.

While it is very difficult, as indicated above, to anticipate the requirements of the purchaser, the manufacturer, by study of records, must endeavor to hit upon a happy medium somewhere in this matter of stock. An attempt to carry a large stock of all classes of pins would quickly remove the profit obtained from the more popular types because of the interest on the investment.

Results to Be Expected

The most obvious result of simplification of insulator pins and other high-tension line hardware would be a reduction in the expenses of the manufacture and his distributor. Advantages equally important would accrue to the ultimate user of this line of equipment if the number of styles and sizes could be reduced. A reduction in the varieties of insulator pins carried would enable the manufacturer to supply demands for rush shipment more easily than is now possible. The manufacturer and distributor could well afford to carry larger stocks of fewer varieties, thereby eliminating the delay and expense of putting through rush orders at the factory.

A reduction in the varieties of styles carried would permit of quicker selection on the part of the purchaser, quicker shipment on the part of the manufacturer and less expense on the part of both the manufacturer and the purchaser due to express transportation charges and other expenses in connection with the rush shipment of special orders. Finally, it would reduce cost to the manufacturer in handling expense and investment in patterns, and dead stock would be reflected in more favorable prices to the purchaser. It is to be hoped that through continued and further co-operation between manufacturers of cross-arms, pins and insulators, together with the purchasers of this equipment, there will result a material reduction in the variety of styles and sizes of this hardware which is an important integral part of the completed transmission line.

Radio Distribution by the Central Station

Public Utility Companies Will Inevitably Become Interested in Selling Radio—Jobber Should Welcome and Encourage Their Interest to Obtain a New Outlet Within the Industry

By David Sarnoff
Vice-President Radio Corporation of America

ELECTRICAL jobbers who distribute radio material have been discussing for some time what the effect is going to be when the central-station companies become more directly interested in radio. The normal course of distribution today is from the radio manufacturer through the jobber to the retailer, who may be either an electrical man, a music man, a department store or any other of the numerous retail shops that are today giving attention to the sale of radio sets and parts. The central station, although already established as a merchandiser of domestic household appliances, has not yet extensively taken up the sale of radio.

It is inevitable, however, that the electric light and power company will some day, and probably soon, become interested in radio. At the present time radio is responsible indirectly for a very considerable central-station load. A few individual central-station companies which have reported the results of a casual survey estimate that the average consumer increases his monthly lighting bill by between 50 and 75 per cent when he installs a radio set. He stays home more, he stays up later, he burns more energy, and in very many cases he charges his storage battery through a rectifier direct from the lighting line.

With upward of three million radio receivers in daily use throughout the country, it is estimated that at least ten million dollars' additional lighting revenue has been added to the income of the electric light and power companies. The central-station people do not realize this, they do not appreciate the subtle influence which radio has already had upon their sales, but it is a question whether radio has not become an energy consumer of the first magnitude and the source of a very considerable profit. I am convinced that any company could demonstrate the accuracy of this statement by the simple process of comparing the amounts of customers' bills before and after these customers acquire radio sets.

What the Jobber Fears

But there is a further development in prospect. The time is coming when the radio receiving set is going to tap its energy direct from the lighting line, and radio will then become not only an indirect but also a direct consumer of central-station energy. This will have an immediate and far-reaching influence upon central-station thinking, and it is but natural to expect that the sale of radio sets in the appliance store of the company will become common practice, for it will offer many appealing benefits—a merchandising profit, a line that will turn over rapidly, a popular appeal that will stimulate an increased store profit, a new bond of interest between the central station and the customer. The radio manufacturer, therefore, clearly foresees the day when the central station will be an active dealer in radio equipment, and the electrical jobber realizes that this is so.

Anxiety has been expressed by the electrical jobber lest the coming of the central station into the radio market build up a large and active retail distribution system that will seek to pass him by and deal directly with the manufacturer. It is an interesting consideration, but it becomes more promising for the jobber the further one gets into it.

Looking at the matter from the standpoint of the jobber's natural desire to build up active retailers in all communities, the central-station company offers a fine outlet because it is in contact with all the best "prospects" for radio sales in all large towns and cities on a basis that permits them to establish credit easily and to handle collections economically on installment sales. The central station is already set up as the headquarters for other electrical household appliances, and as a merchandising agent it is steadily becoming more proficient and intelligent. In my opinion, therefore, the jobber should welcome and encourage the central station to take an early interest in radio that he may obtain a new outlet essentially within the electrical industry with which he has an established standing.

IN THE JOBBER'S HANDS

The fear of the jobber that the central station may buy over his head direct from the manufacturer is a matter largely within the jobber's own control, for the central-station sales manager will hold the value of good service above all other considerations, and any jobber who maintains an active and efficient radio department with a service adequate to satisfy the department store or the active radio shop will have no smaller an opportunity to sell to the central station when it becomes an active retailer of radio.

It would seem to me, therefore, of the highest importance that both the radio manufacturers and the electrical jobbers establish right now the policy of anticipating the coming of the central-station company as an active radio retailer and that we begin right now to educate the central-station commercial executives to an appreciation of this coming opportunity. If the jobber mistrusts the effect that the entry of the central station into the market is going to have, he may lose the opportunity to prepare the way, but he cannot materially retard the trend. Rather, his opportunity lies in immediately establishing himself with the central station as the natural source of supply and convincing it of the fact that the jobber offers a radio service vital to his interests as a retailer.

Undoubtedly the coming of the central station as a retailer will bring great impetus to the radio market. It is for the jobber to say whether or not he will guide and stimulate this trend.

Business Conditions

DEFINITE improvement in industrial business continues, with a general buying of equipment, and many small orders are being received by manufacturers. These orders for the most part cover material for delayed work that is now being undertaken. The trend is upward, and a gradual betterment is anticipated, presaged by increased negotiations now under way that include much equipment. Prices have shown a tendency to stiffen, manufacturers showing less inclination to make concessions on lump-sum jobs. At present there are no indications of any general increase in prices.

As expressed by a large manufacturer, there is no great change in sales, but business is better and in healthier condition. Buying is conservative, and there is no intention on the part of purchasers to be swept off their feet, but rather more evidence of the application of sound business principles than in many years. The Radio Corporation has just announced a 25 per cent reduction on the price of vacuum tubes and also reductions in its line of radio sets. Steel production continues to gain, but iron and steel scrap has been declining since January 1.

In the New England district utility and industrial equipment is selling well, and many proposals are under way for factory-lighting and power equipment. The trend of industrial buying is upward in the New York district, and there is general buying of equipment in small orders, with many prospective large sales being negotiated. In the Southeast Florida continues to be the most active purchaser, and many orders for all lines of electrical materials and "white-way" equipment have been received from this state. Good maintenance purchases are being made in the Middle West. Industrial sales are active, and motor sales are said to be 20 per cent to 50 per cent greater than they were a year ago. On the Pacific Coast a good cross-arm business is predicted for this year, but the demand for poles will not be proportionate. Sales to contractors are good in that territory.

Metal Market Inactive—Prices Decline Further

FURTHER declines have occurred in the prices of the important nonferrous metals, and as is nearly always the case consumers show little interest in a declining market. A few sales of important tonnages have, however, been made in the last two or three days, and a better tone in the London market has encouraged sellers. Copper consumption continues good, though the brass mills have been somewhat disappointed with the volume of new orders recently. Most of the larger producers are not in the market as they believe the present price recession is only temporary, and there is sufficient business on their books. Some sellers have booked small tonnages at 14¼ cents for prompt shipment. Forward copper is somewhat more difficult to obtain in the open market than prompt.

NEW YORK METAL MARKET PRICES

	Jan. 28, 1925 Cents per Pound	Feb. 4, 1925 Cents per Pound
Copper, electrolytic	14¼	14¼
Lead, Am. S. & R. price	10	9¾
Antimony	16¼	18¼
Nickel, ingot	31	31
Zinc, spot	7.975	7.70
Tin, Straits	57¼	57
Aluminum, 98 to 99 per cent	28	28

The American Smelting & Refining Company reduced its contract price for lead from 10 cents to 9¾ cents on Friday, January 30. Not many sales have been made, but an important tonnage was sold on Tuesday at 9.45 cents, New York. Consumers apparently are refraining from buying owing to the continual decline in prices. Only a moderate tonnage of zinc has been sold, and there has been no export business. Tin buying has been on a small scale with some interest shown on declines.

Utility and Industrial Equipment Selling Well in New England

SMALL industrial electric furnaces, power-factor corrective apparatus and poles are moving well in the New England district as the tide of business rises, and not a few proposals are under way for factory lighting and power equipment. Three 15-kw. pot furnaces have been sold to Connecticut manufacturing plants, and small motors are in good demand. The Lowell (Mass.) Electric Light Corporation is in the market for a 12,500-kw. steam turbo-generator, and a 4,800-kva. static condenser has been sold to the United Illuminating Company, Bridgeport, Conn. Static-condenser equipment has also been purchased for installation on the system of the Vermont Hydro-Electric Corporation.

An order for four carloads of pipe is about to be closed for Greater Boston use, and four carloads have been purchased by the United Electric Light Company, Springfield, Mass. It is authoritatively reported that a large Massachusetts central-station company will soon be in the market for several electric trucks. Appliance sales are dull, although one utility group records a demand greater than that of last year. Interest is awakening in domestic refrigeration, and radio sets are selling in large volume.

Trend of Industrial Buying Upward in New York District

THE trend of industrial buying in the New York district remains upward and there is general buying of equipment in small orders, with a few larger orders being placed here and there. Many prospective large sales are being negotiated and a gradual betterment in orders received is expected to continue. There will apparently be ample capacity to take care of the demand without affecting deliveries. With copper and steel prices rising, prices of equipment are showing a tendency to stiffen up. No increase in list prices is anticipated, but the upward tendency is evidenced in the lessening desire of manufacturers to make concessions on lump-sum jobs as was formerly the case.

Construction materials have been in good demand and sales of wiring devices are active. One manufacturer of that type of supplies reports better sales in January than in any previous year. Industrial and commercial lighting equipment is in very good demand. One company states that its sales last month were $18,000, as compared with $6,000 for the same period last year. In general it can be said that considerably

more sales are being negotiated and that business in that equipment is 50 per cent ahead of last year.

Good Maintenance Purchases in Middle West—Industry Active

UTILITY purchases have not been very active in the Middle West, although a number of large projects are known to be pending. Quotations on several large cable orders are being made by various manufacturers and one utility company is obtaining quotations on a number of pieces of major apparatus. Maintenance purchases have increased somewhat.

Industrial purchasing continues quite active, and motor sales for January are said to be 20 per cent to 50 per cent greater than for the same month in 1924. The various railroads are apparently coming into the market for more and more materials. During January orders for cross-arms for immediate shipment were said to be approximately 20 per cent greater than for the same month in 1924. Inquiries for future delivery are specially numerous. Transformer sales are reported 15 per cent to 20 per cent below January, 1924. The number of orders have been greater but the average value less. However, one large manufacturer states that he has had a 33 per cent increase in kva. and dollar value. Jobbers in most cases have had fairly good sales this week. The volume of business has been satisfactory and well distributed over most lines. Electrical appliances have had a ready sale and radio apparatus was much in demand.

Buying in Southeastern District Chiefly from Florida

FLORIDA continues to be the outstanding purchaser in the Southeastern district. Orders for all lines of electrical materials and "white-way" equipment from this state are in good volume. Purchases from Alabama, Florida and Georgia by central-station companies for line and construction materials are brisk, with high-tension transformers of from 1,000 kw. to 2,000 kw. capacity in satisfactory demand. Purchases of low-tension transformers of 100 kw. and less capacities, with a proportional volume of watt-hour meters, are reported good. Reports on the demand for electric ranges are contradictory, one manufacturer's representative stating that his business in January has increased 95 per cent over the same month in 1924, while another reports a decrease under the same comparison. Industrial business, while temporarily slow on account of inclement weather conditions, is really on the upgrade and several nice orders are in prospect, while one order for a 2,000-kw. turbine was recently received. Damage from flood conditions in south Georgia is expected to run into large totals.

Good Cross-Arm Business Predicted on the Pacific Coast

GOOD cross-arm business is predicted this year on the Pacific Coast, although orders for poles will not be proportionate on account of the number that have been carried over from last year's contracts, particularly in southern California. Business from contractors is good, their orders, as is customary early in the month, covering the maximum price assortments. Rubber-covered wire and outlet boxes are among the present best-selling supply lines. There have also been persistent rumors of price advances in these commodities, although nothing definite has yet taken place.

Among recent orders and inquiries

Value of Electrical Exports for December, 1924, and for Entire Year, Compared with 1923

(Issued by Bureau of Foreign and Domestic Commerce)

	December, 1923	December, 1924	Year 1923	Year 1924
Generators:				
Direct-current—				
Under 500 kw.	$48,687	$62,008	$788,300	$1,067,206
500 kw. and over	4,180	5,345	753,100	849,777
Alternating-current—				
Under 2,000 kva.	13,264	15,317	127,485	169,156
2,000 kva. and over	53,282	18,500	1,284,047	1,157,167
Steam-turbo-generator sets	*	86	*	74,623
Accessories and parts for generators	92,220	58,328	1,025,218	1,269,927
Self-contained lighting outfits	37,455	53,864	610,017	780,124
Batteries:				
Primary	87,479	*	1,272,619	*
Flashlight	*	82,287	*	893,368
Other primary	*	68,180	*	817,604
Storage	174,103	233,151	2,344,232	2,882,847
Transforming or converting apparatus:				
Power transformers	384,466	119,140	3,195,240	3,286,161
Other transformers	68,301	85,954	760,268	2,368,052
Rectifiers, double-current and motor generators, dynamotors, synchronous and other converters	160,418	125,696	999,144	1,156,636
Transmission and distribution apparatus:				
Switchboard panels, except telephones	224,202	66,241	1,667,798	2,163,364
Switches and circuit breakers over 10 amp.	116,353	80,519	1,796,174	2,245,341
Fuses and fuse blocks	33,375	20,662	311,457	282,142
Watt-hour and measuring meters	82,217	28,823	518,834	623,889
Volt, watt and ampere meters and other recording, indicating and testing apparatus	107,523	98,826	1,027,080	1,367,063
Lightning arresters, choke coils, reactors and other protective devices	56,217	45,038	615,547	920,313
Motors, starters and controllers:				
Motors under 1 hp.	118,325	101,815	1,727,646	1,687,170
Stationary motors—				
1 to 200 hp.	227,912	111,287	3,088,078	2,392,436
Over 200 hp.	121,389	14,344	813,468	575,562
Railway motors	64,169	31,949	659,825	1,328,453
Electric locomotives:				
Railway	245,555	10,695	3,037,140	1,923,113
Mining and industrial	5,323	32,160	277,227	319,927
Other motors	29,238	†	230,625	†
Starting and controlling equipment	200,400	*	1,751,707	*
For industrial motors	*	48,798	*	1,429,054
For electric railway and vehicle motors	*	5,018	*	106,885
Accessories and parts for motors	170,440	103,700	1,659,051	1,998,425
Electrical appliances:				
Electric fans	$53,927	$28,859	$859,045	$1,028,018
Electric lamps:				
Incandescent—				
Carbon-filament	7,523	3,542	61,742	54,407
Metal-filament	112,547	51,547	1,130,861	1,069,558
Other electric lamps	19,369	32,223	234,721	310,146
Flashlights	38,966	84,023	494,327	776,330
Searchlights and projectors	23,820	35,159	366,298	380,679
Motor-driven household devices	83,489	63,384	865,861	887,787
Domestic heating and cooking devices	111,799	98,324	984,471	1,104,086
Industrial electric furnaces and ovens	7,943	23,934	214,068	239,709
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc.	76,117	78,401	870,639	1,058,431
Signal and communication devices:				
Radio and wireless apparatus	335,308	1,080,168	3,448,112	6,030,914
Telgraph apparatus	39,202	28,365	690,112	515,620
Telephone apparatus:				
Magneto telephones	5,194	10,906	196,330	182,886
Other telephones	99,696	28,342	405,887	542,786
Magneto switchboards	1,818	*	119,039	13,873
Other telephone switchboards	3,370	1,389	403,309	1,146,878
Other telephone equipment	*	178,798	*	2,096,285
Railway signals, switches and attachments	53,194	54,862	737,537	964,001
Bells, buzzers, annunciators and alarms	8,060	7,460	107,447	148,738
Other electric apparatus:				
Spark plugs, magnetos and other ignition apparatus	209,002	139,328	1,695,167	1,911,117
Insulating material	131,994	112,772	1,435,545	1,536,182
Metal conduit, outlet and switch boxes	35,506	42,321	478,063	573,568
Sockets, receptacles and lighting switches	82,081	85,530	1,077,404	1,278,276
Other wiring supplies and fixtures	167,386	†	1,891,466	†
Electric lighting fixtures, interior and street	*	74,366	†	754,578
Other wiring supplies and line materials	*	51,944	*	1,149,480
Other electrical apparatus not elsewhere specified	832,525	638,115	8,821,921	7,937,616
Globes and shades for lighting fixtures	32,078	31,734	468,114	400,791
Electrical glassware, except for lighting	17,728	9,161	184,276	241,558
Electrical porcelain	177,783	160,079	1,783,614	1,767,323
Electrical carbons, carbon brushes, electrodes	230,259	179,324	2,317,495	2,978,857
Insulated wire and cable (iron and steel)	48,622	24,578	686,613	397,804
Other manufacturers of aluminum	142,786	52,377	1,167,128	870,655
Copper, bare wire	255,960	87,548	1,972,800	1,701,656
Copper, insulated wires and cables	209,233	259,799	3,140,027	3,895,763
Total	$6,581,778	$5,565,132	$71,646,796	$82,082,141

* Not separately stated prior to January 1, 1924.
† Discontinued beginning January 1, 1924.

are two orders for 10,000 lb. each of No. 4 copper strand, one from a railroad and the other from a lumber company 105 miles "BB" iron wire, 5,000 guy clamps and 200,000 ft. assorted rubber-covered wire. Among miscellaneous items that have been selling well recently are fuse plugs in lots of 10,000 and over, which have been purchased by power companies, flashlamps and intercommunicating telephones for apartments and industrials. In the Puget Sound district the municipal lighting department plans a range campaign starting February 15. The Puget Sound Power & Light Company also plans a campaign to start April 1. Collections have been improving and are tightening up a little after holiday concessions. The average has been somewhat lowered by a considerable increase in the number of neighborhood dealers, especially those who handle radio material and who reinforce such business by handling small contracting jobs.

Activities of the Trade

George W. Dunham Corporation to Manufacture New Washer

A new arrival in the electrical appliance industry is the George W. Dunham Corporation of Utica, N. Y., recently incorporated to manufacture electrical labor-saving appliances. The company will market as its initial product an electric centrifugal washer and dryer and plans soon to add other lines.

George W. Dunham, president was formerly consulting engineer and assistant general manager of the Savage Arms Corporation. Richard U. Sherman, vice-president and treasurer, is president and treasurer of the Pratt Chuck Company of Frankfort, N. Y., manufacturer of electrical fittings, metal stampings and chucks. James McClymont, vice-president and sales manager, has been active in the electric appliance field for years. He has recently been director of sales of the appliance division of the Savage Arms Corporation and was previously secretary and treasurer of the Laundryette Sales Company of New York. Other officers and directors include Winthrop T. Scarritt, vice-president in charge of production, and Charles A. Woodruff, purchasing agent. The corporation will shortly announce its new washer to the trade.

Circuit Court Upholds Johnson Balanced-Valve Patent

The United States Circuit Court of Appeals for the Sixth Circuit has affirmed the decision of Judge Westenhaver in the United States District Court for the Northern District of Ohio upholding the Johnson patent No. 1,030,890, owned by the William Cramp & Sons Ship & Engine Building Company, and holding that the patent is infringed by the balanced valve manufactured by the Wellman-Seaver-Morgan Company of Cleveland.

The type of valve involved was that installed by the I. P. Morris department of the William Cramp company at Niagara Falls and many other hydraulic power plants throughout the country for controlling the flow of penstock water to the turbines. The defendant's valve was alleged to differ from the valve of the Johnson patent in exhausting a large part of the pressure to atmosphere instead of into the conduit, and in other particulars. The District Court had held these differences to be immaterial, and the Circuit Court of Appeals in its opinion accepted and approved in all substantial respects the disposition and treatment of the case by the district judge.

Kelvinator Corporation Merges with Detroit Carrier

The Kelvinator Corporation, Detroit, manufacturer of electric refrigeration machines, ice-cream cabinets and electric refrigeration cabinets, has announced a merger with the Detroit Carrier & Manufacturing Company, which supplies about 80 per cent of the tire carriers used by automobiles in this country. During the last few years the Kelvinator Corporation purchased a large portion of its stampings and materials from the Detroit Company, and this consolidation, according to A. H. Goss, president of the Kelvinator Corporation, will assure Kelvinator of a continued source of materials and will result in more economical operation for both companies due to reduced overhead.

The surplus capacity of the Detroit Carrier & Manufacturing Company's large modern plant will also be utilized to take care of the expansion and increasing business of Kelvinator. A public offering of a block of the stock of the new corporation, which will also be known as the Kelvinator Corporation, was made this week.

The Pure Carbon Company, Wellsville, N. Y., manufacturer of carbon brushes for motors and generators and carbon specialties, announces that H. H. Miller, 7719 Lyman Street, Pittsburgh, as well as the Simpson Power Equipment Company, 7016 Euclid Avenue, Cleveland, have been appointed as its representatives. The company also announces the opening of offices in the General Motors Building, Detroit.

The Nordberg Manufacturing Company, Milwaukee, Wis., has been awarded the contract by the United States government for the installation of three 3,750-hp. Diesel engines in the Panama Canal zone to be used as supplementary equipment to the present limited capacity of the hydro-electric plants.

The Allis-Chalmers Manufacturing Company has been awarded the contract for the generators which will be direct-connected to the above engines.

The A-A Wire Company announces that its plant has been moved to larger quarters at Harrison, N. J., where increased and modern equipment provides ample facilities for handling the increasing demand for its rubber-covered wires and cables. All matters pertaining to distribution of sales will be handled as heretofore at 110 East Forty-second Street, New York City.

The Western Electric Company has awarded a contract for $170,000 for electrical work at its West Side Shops, Kearny, N. J., to J. P. Hall-Smith, New York City.

The Baker Dunbar Company, Cleveland, manufacturer of the "Arrow" ash handling equipment, announces that Wolff & Company, Wrigley Building, Chicago, has been appointed territorial representative in Chicago.

The U. G. I. Contracting Company, Philadelphia, has recently been awarded a contract covering the construction of Lock 51 on the Ohio River near Golconda, Ill. The amount of the contract exceeds $1,000,000, and it will require two years for completion. It includes the placing of 34,000 yd. of concrete and the building of a cofferdam nearly one-half mile in length.

Hubbard & Company, Pittsburgh, manufacturer of pole-line hardware, etc., announces the appointment of Fred E. Norman as manager of specialty sales. Mr. Norman has been advertising manager for the past three years and has had broad experience in pole-line construction from the practical and sales standpoint. The company also announces the appointment of A. R. Robitzek as manager of hardware sales.

The Globe Electric Company, 14 Keefe Avenue, Milwaukee, manufacturer of storage batteries, farm-lighting and power plants, etc., has preliminary plans for a one-story brick addition, 35 ft. x 120 ft.

The Seneca Wire & Manufacturing Company, Fostoria, Ohio, has plans underway for the construction of a one-story factory building, 190 ft. x 200 ft., according to L. E. Kinn, president of the company.

The F. W. Wakefield Brass Company, Vermilion, Ohio, announces the completion of its new factory building, erected by the Austin Company of Cleveland, which replaces the one destroyed by fire on the night of Dec. 4 last. The company also announces that A. F. Wakefield, vice-president for the past two years, has been made general manager, taking over the bulk of the executive work formerly handled by F. W. Wakefield, president of the company.

The Clean-Heat Appliance Company, 604 Mission Street, San Francisco, has placed on the market an electric heater for use where warm, hot or boiling liquids are desired. The unit which is nickeled and supported by a white enameled stand consumes 200 watts and operates from any standard socket at 110-120 volts.

The English Electric Ltd., Preston, England, has been awarded the contract for the electrical equipment required for the electrification of the suburban lines of the South African Railways in the neighborhood of Cape Town. The lines to be electrified are those running from Cape Town to the naval port of Simonstown and the seaside resorts of Kalk Bay and Muizenberg on False Bay and from Cape

Town to Sea Point. The contract calls for between one and a half and two million dollars' worth of electrical equipment consisting of eighty-three motor coaches and 133 trailer coaches to be operated on a 1,500-volt direct-current system.

The Security Electric Manufacturing Company, 2635 Canton Street, Chicago, manufacturer of electric heating appliances, has awarded a general contract for the erection of a one-story factory addition, 50 ft. x 125 ft., to cost about $25,000.

New Equipment Available

Electrostatic Oscillograph

An electrostatic oscillograph for use with potentials of from 5,000 volts to 250,000 volts has been developed by the Cox-Cavendish Electrical Company, Ltd., Harlesden, N.W. 10, England. The instrument consists of a strip of phosphor bronze or steel, 1.75 cm. long, stretched between ebonite jaws, the tension of which is adjustable by means of a sliding nut and screw. A mirror of elongated form is attached at one end to the center of the strip, while the other end rests on an adjustable ebonite pillar, forming a fulcrum so that the mirror rocks through a small angle in response to any movement of the strip.

The movement is immersed in oil, which serves both for insulating and damping purposes. Opposite to the center of the strip is the attracting plate embedded in an ebonite rod which passes through the container wall, while on the side of the strip away from this is small plate of metal in electrical connection with the strip and therefore repelling it. A window in the container passes a beam of reflected light for observation or recording. To obtain different ranges of potential a number of containers, fitted with attracting plates at various distances and shielded by different thicknesses of ebonite, are used.

Unit-Type Electric Furnace Element

A new unit-type electric furnace element that may be installed in new or existing furnaces, known as the "type S," has been placed on the market by the Westinghouse Electric & Manufacturing Company. The elements consist of specially formed nickel-chromium rod of the reverse-bend-type coil. They are made in many standard ratings and lengths to permit their application to various sizes of furnaces and to different processes.

The elements are supported at intervals of about 12 in. along their length by refractory cleats. These cleats are held in place between T-shaped bricks of standard size embedded in the furnace wall. The coils can be mounted on the walls, roof or floor of the furnace. If mounted on the floor, they must, of course, be protected by plates of a non-oxidizing alloy to prevent injury when charging the furnace. A double bank of heating elements can be used, if desired, which, together with the various sizes of coils, will give a wide range of heating capacity. Coil ends within the furnace chamber can be joined by the oxide connector, another Westinghouse product, which eliminates welds and insures a joint that is easily assembled and has great mechanical strength and high conductivity. It is at the same time easy to remove. Automatic control apparatus may be used with these elements, if desired.

Maximum-Demand Meter

A chart-recording maximum-demand meter known as the "Maxigraph" has been placed on the market by Landis & Gyr, Ltd., Zug, Switzerland, through its American representatives, L. H. Junod & Company, 104 Fifth Avenue, New York. The recording mechanism

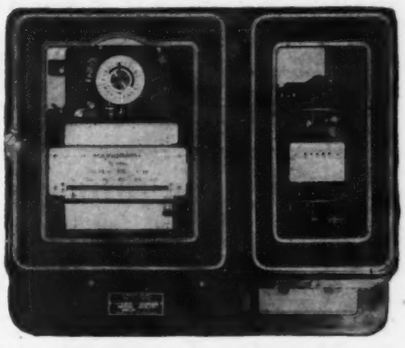


FIG. 1—MAXIMUM-DEMAND METER THAT REGISTERS MAXIMUM REACTIVE KVA. OR MAXIMUM KVA.

is independent of the meter as shown in the illustration, and this is said to assure sustained accuracy of the meter. The recording mechanism forms one unit with the clock and the electric motor, which besides operating the recording gear also winds the clock at regular intervals. The instrument is furnished for any demand interval and any frequency in practice. The clock has a Swiss movement regulated to keep time to within plus or minus 0.02 per cent, and in cases where an extremely high degree of accuracy is required this error can be reduced by checking the clock over fairly long intervals after installation and adjusting it accordingly.

FIG. 2—TYPE OF CHART OBTAINED FROM MAXIGRAPH; WRITING DONE WITH METAL WHEEL WITHOUT INK

The Maxigraph can also be applied for the registration of measurements, which makes it possible to draw a curve giving the variations of power factor over the entire period (about eighty days) covered by the chart. The measuring unit in such a case consists of two Maxigraphs, one being connected with a standard watt-hour meter, the other with a reactive component meter. Both Maxigraphs work in synchronism as to demand intervals, so that for every demand interval there is a record of the maximum kw. on one chart and of the maximum reactive kva. on the other chart.

Double-Suction Centrifugal Pump

A double-suction, single-stage centrifugal pump, including a device which is claimed to neutralize end thrust automatically, has been placed on the market by the Earle Gear & Machine Company, 4707 Stenton Avenue, Philadelphia. The end thrust is neutralized by obtaining a hydraulic balance on both sides of the impeller. Thrust bearings or collars are not required, but small fixed collars are placed on the shaft, being set at a distance from the face of the bearing bushing. After the limit of allowable wear has occurred within the case, the engagement of the collars and bearings becomes an indication of the need of replacement of wearing parts within the pump. Split babbitted bearing shells with two oil rings are provided. Bronze sleeves are used to protect the forged steel shaft from the action of the liquid handled.

Switchboard Instruments

The horizontal edgewise switchboard indicating instruments manufactured by the General Electric Company and known as its type H-2 have been redesigned and designated as type H-5. Among the changes made are improved armature coil and pointer construction and a new strip-wound magnetic shield. The jewels and pivots in the instruments have also been reversed to permit their ready removal. Resistors for the new wattmeters and voltmeters have been mounted inside the instruments for the purpose of simplifying switchboard wiring and of saving space.

Three-Speed Ventilating Fan. — A three-speed ventilating fan having blades 16 in. in diameter and with the motor bolted to a 20-in. cast-iron supporting ring has been placed on the market by the Century Electric Company, St. Louis. The fan is provided with a separate controller mounted in a japanned iron box.

Automatic Door Device.—An electrically operated automatic door device is being manufactured by the Varnum Door Engine Company, Los Angeles, Cal. This device opens and closes heavy doors and gates noiselessly and automatically. It is intended for use in banking institutions for opening and closing the gates of the safe-deposit vaults and for large residences where the gates to the grounds are ponderous and heavy. It is operated by a ½-hp. Westinghouse motor, which not only furnishes driving force, but also stops the door at the proper point, thus preventing slamming either in the opening or closing action.

New Trade Literature

TRANSFORMERS. — The Pittsburgh Transformer Company, Pittsburgh, has issued bulletin No. 2,036, describing the "Pittsburgh" transformers. It contains an illustration showing a 1,000-kva., 250,000-volt testing transformer. Attention is also called to the "Pittsburgh" automatic safety valve, which is standard equipment on all its power transformers. Bulletin No. 2,037 covers the "Pittsburgh" high-voltage power transformers. Illustrations are given showing a 2,000-kva., 114,000-volt transformer coil and an installation of three 2,500-kva., 66,000-volt transformers in a public service plant.

HEAT BALANCE.—A bulletin entitled "The Heat Balance in Steam Power Plants" has been issued by the Bailey Meter Company, 2015 East Forty-sixth Street, Cleveland. It contains a discussion and diagrams which show how modern power plants are able to convert into steam approximately 90 per cent of the heat available in the fuel by consistently maintaining the controllable losses at a minimum. There are also a number of simple formulas given by means of which the heat balance of a steam station may be calculated from the information given by "Bailey Meters and Recorders." A diagrammatic layout giving the application of meters and instruments is included. Views of actual installations are also shown to illustrate the type of equipment and panel arrangements which have been adopted by a number of large central-station companies and industrial plants.

PORTABLE ELECTRIC TOOLS.—Catalog No. 8 issued by the Black & Decker Manufacturing Company, Towson, Md., describes the "Black & Decker" portable electric tools and shop equipment, including portable electric drills, grinders, valve grinders, socket wrenches, post and bench drill stands, electric bench and pedestal grinders, etc.

OIL-ELECTRIC LOCOMOTIVE. — The General Electric Company, Schenectady, N. Y., is distributing bulletin No. 44103.1, which describes and illustrates the 60-ton oil-electric locomotive developed by the General Electric, American Locomotive and Ingersoll-Rand companies. It contains photographs of the locomotive in service, views of the interior and tables of operating data and specifications.

OIL ENGINES.—Bulletin No. 184 issued by the De La Vergne Machine Company, 940 East 138th Street, New York City, covers the "De La Vergne" horizontal-type "SI" oil engines, without air compressors. Illustrations are given showing various installations, and specifications with dimensioned sketches are included.

SPLIT-PHASE INDUCTION MOTORS. —Bulletin No. 142 issued by the Wagner Electric Corporation, St. Louis, describes the "Wagner" split-phase induction motors, "BB" type. Attention is called to their predominating features and operating characteristics.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Australia (No. 13,485) of electrical equipment for motor coaches and trail cars.

Purchase is desired in France (No. 13,398) of cranes, dock and shiploading equipment; (No. 13,399) of ice-making and refrigerating machines, equipment and supplies; (No. 13,484) of lighting supplies, house motors and pumps, electrical apparatus, etc.; (No. 13,397) of acetylene and electric welding machines.

Purchase is desired in Germany (No. 13,487) of dry and storage batteries for automobiles.

Purchase is desired in India (No. 13,483) of electrical goods and machinery.

Purchase is desired in Norway (No. 13,430) of engines, four and six-cylinder, for automobiles, equipped with carburetors and starting and lighting equipment.

Purchase is desired in South Africa (No. 13,452) of rubber jars for automobile batteries.

An agency is desired in Argentina (No. 13,434) for electrical goods.

An agency is desired in Brazil (No. 13,486) for radio sets and parts.

An agency is desired in France (No. 13,489) for electric motors, small transformers, electric fans and pumps; (No. 13,487) for radio supplies.

An agency is desired in Norway (No. 13,385) for passenger and freight elevators.

An agency is desired in Egypt (No. 13,488) for electrical goods, medium-priced.

New Incorporations

THE GEORGIA HYDRO-ELECTRIC COMPANY has filed articles of incorporations under the laws of the State of Delaware, with a capital stock of $1,000,000, to construct hydro-electric plants. The incorporators are T. L. Croteau, A. L. Miller and M. A. Bruce, Wilmington, Del.

THE INTERNATIONAL HYDRO-ELECTRIC CORPORATION, New York, N. Y., has been chartered by C. Shepherd, 18 Kraft Avenue, A. H. White, Glen Washington Road, Bronxville, N. Y., and C. S. Colson, 27 Monroe Place, Brooklyn, N. Y., to develop water power.

THE SUBURBAN MUTUAL ELECTRIC LIGHT & POWER COMPANY, Shelby, N. C., has been incorporated by R. B. Costner, Clarence Mode and others.

THE WESTERN GAS & ELECTRIC COMPANY, Fort Collins, Col., has been incorporated with a capital stock of $500,000 by B. E. Harris, J. E. Simmons and R. W. Shimers, Fort Collins.

THE MELBOURNE (IOWA) ELECTRIC COMPANY has been incorporated with a capital stock of $20,000 to generate and distribute electricity in Melbourne. R. H. Flathers is president and H. V. Meier secretary and treasurer.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

ATTLEBORO, MASS.—The Board of Alderman is considering the construction of a power house in West Mansfield to supply power to the city of Attleboro.

BOSTON, MASS.—The local supply officer, Navy Department, has been authorized to purchase twenty-five lighting units, 1,000-watt capacity, two panelboards and cabinets (N. S. A. F. Req. 495).

WEYMOUTH, MASS.—Plans are under way by the Edison Electric Illuminating Company of Boston for the erection of a 110,000-volt transmission line from Weymouth to Walpole and West Medway, including the erection of outdoor switching stations and initial transformer equipment of 110,000 kva. The initial installation at Weymouth comprises two 32,000-kw. units.

ROXBURY, CONN.—The New Milford (Conn.) Electric Light Company has applied to the State Legislature for permission to extend its high-tension transmission line to Roxbury to furnish electrical service here.

Middle Atlantic States

BROOKLYN, N. Y.—The American Sugar Refining Company, 117 Wall Street, New York, plans to install electric power equipment in connection with proposed extensions and improvements in its local refining plant, to cost about $6,000,000.

BUFFALO, N. Y.—Bids will be received by Frank X. Schwab, Commissioner of Public Safety, City and County Hall, until Feb. 26, for the installation of a flashlight police-signal system in the Second, Fourth, Fifth and Sixth Precincts. Plans and specifications at the office of the Superintendent of Motive Power and Supplies, Police Headquarters, Seneca and Franklin Streets.

GOUVERNEUR, N. Y.—Steps have been taken by the Chamber of Commerce to further the project to establish a municipal electric plant, for which a bond issue of $100,000 was authorized by the voters on Oct. 22, 1923.

HARTFORD, N. Y.—The Adirondack Power & Light Corporation, Schenectady, has applied to the Public Service Commission for approval of a franchise from the town of Hartford for extension of its electric service here.

KEENE, N. Y.—The Northern Adirondack Power Company, Keeseville, has applied to the Public Service Commission for approval of a franchise in Keene and for permission to erect a distribution system in the town. The company has purchased the local system of the Ausable Valley Light, Heat & Power Company and plans to extend its transmission line from Upper Jay to connect with the Ausable system. Another extension will be built to serve the Keene Valley.

KIRKLAND, N. Y. — Application has been made to the Public Service Commission by Fred L. Nelson, Deansboro, for permission to sell the local electric distribution system in Kirkland and in Marshall to the New York State Gas & Electric Corporation, Ithaca, which proposes to connect the distribution systems with its transmission lines.

MIDDLE GROVE, N. Y.—Arrangements have been made with the Adirondack Power & Light Corporation, Schenectady, to extend its lines to Middle Grove to furnish electric service here.

NEW YORK, N. Y.—The Department of Plant and Structures has taken out a building permit for a power plant on 167th Street near Walton Avenue, to cost about $400,000. Charles B. Meyers, 31 Union Square, is architect.

RANDOLPH, N. Y.—The Village Board is considering extensions to the street-lighting system. The Iroquois Utilities, Inc., Syracuse, furnishes electrical service here.

NEWARK, N. J.—The Public Service Electric & Gas Company has filed plans for the construction of an addition to its substation on Fenwick Street, to cost about $35,000.

CHESTER, PA.—The Scott Paper Company has acquired a site at the corner of Front and Market Streets on which it proposes to erect a filtration plant and later to build a power house.

SHARPSVILLE, PA.—Steps have been taken by the Sharpsville Improvement Association in conjunction with the Village Board for the installation of an ornamental lighting system between Thornton Hollow and Erie Depot, to cost approximately $35,000.

BALTIMORE, MD.—The Municipal Electric Commission is considering the installation of electric lamps on Mount Royal Avenue from Oliver to North Avenue, on Broadway from Baltimore Street to North Avenue, and on Monroe Street from North Avenue to the Washington Boulevard, to replace the present gas lamps. C. F. Goob is chief engineer.

BENWOOD, W. VA.—The Wheeling (W. Va.) Electric Company, it is understood, plans to build a large substation on Bessemer Street at the foot of Eleventh Street.

FAIRMONT, W. VA.—The State Board of Control, Charleston, will install a transformer station in the proposed addition to the local state normal school, for which bids are being asked on general contract until March 2. R. A. Gillis, Fleming Building, Fairmont, is architect.

DENDRON, VA.—The Surrey Lumber Company contemplates installing electric power equipment in connection with the rebuilding of that part of its box-manufacturing plant recently damaged by fire, with loss of about $250,000.

RADFORD, VA. — The Appalachian Power Company is negotiating for the purchase of the municipal light and power plant and proposes to make extensions in this district.

North Central States

BAY CITY, MICH.—The Consumers Power Company, Jackson, is considering extensions to its local steam-operated generating plant, to cost about $145,000.

EXETER, MICH.—The Council has granted a franchise to the Detroit Edison Company to furnish electric service here.

MAYBEE, MICH.—The village of Maybee has granted the Detroit Edison Company a thirty-year franchise to supply electricity for lighting and power purposes subject to the approval of the voters.

CLEVELAND, OHIO.—Separate bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Feb. 13 for fiber conduits and distributing transformers for the Division of Light and Power.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioners

of Purchases and Supplies, City Hall, until Feb. 13 for underground cable for installation of flashlight recall system for the Fourteenth Police Precinct.

LOUISVILLE, KY.—The J. D. Hollingshead Company, 208 South La Salle Street, Chicago, is planning to install electric power equipment in connection with the proposed rebuilding of its local cooperage plant, recently damaged by fire with loss of about $200,000.

PINEVILLE, KY.—The Kentucky Utilities Company, Marion E. Taylor Building, Louisville, is planning to build a dam at the Fourmile plant on the Cumberland River.

LAFAYETTE, IND.—Among the extensions contemplated by the Interstate Public Service Company, Indianapolis, is the erection of a 115,000-volt transmission line from the Oakdale plant of the Indiana Hydro-Electric Power Company, Monticello, 22 miles long, to cost about $115,000; also a 66,000-volt line from Bedford to Bloomington, to cost about $45,000, for which towers have already been erected.

MOLINE, ILL.—Plans are under consideration for remodeling the ornamental lighting system. It is proposed to change the present five-cluster lamps to single units.

LANCASTER, WIS.—Extensions and improvements are contemplated by the Interstate Power Company, Chicago, involving an expenditure of about $1,500,000. It is proposed to enlarge its generating, transmission and distributing systems now serving communities in Wisconsin, Iowa and Minnesota. Plans for additions in Wisconsin call for the erection of a high-tension line from Bloomington, Wis., to Dubuque, Iowa, 30 miles long. The present transmission line extending from Bridgeport to Prairie du Chien will be changed to a double-circuit line, enabling energy to be received direct from Dubuque. A transmission line will also be built from Gays Mills to Soldiers Grove.

HIBBING, MINN.—The City Council is considering a four-million-dollar bond issue for a municipal heating system, including the construction of heating mains to all parts of the city.

ST. PAUL, MINN.—The installation of an ornamental lighting system on Snelling Avenue between Dayton and Hague Avenues and on Selby Avenue from Fry Street to Saratoga Avenue is under consideration by the City Council.

CEDAR FALLS, IOWA.—The City Council has authorized bids advertised for construction of an addition to the municipal electric plant, to cost about $27,000. C. H. Streeter is superintendent.

DUBUQUE, IOWA.—Arrangements are being made to double the output of the power plant of the Dubuque Electric Company, a subsidiary company of the Utilities Power & Light Company, Chicago. Surveys are now being made for the erection of a transmission line to extend north from Dubuque to link up with properties in Iowa, Wisconsin and Minnesota, controlled by the Utilities Power & Light Corporation. The present plans include the erection of many transmission lines in all directions.

KANSAS CITY, MO.—Plans for the proposed local mail-order distributing plant to be erected by Sears, Roebuck & Company, Homan and Arthington Streets, Chicago, include a power house. The cost of the project is estimated at $4,000,000. G. C. Nimmons & Company, 122 South Michigan Avenue, Chicago, are architects.

KANSAS CITY, MO.—Bids will soon be asked (about Feb. 15) by the Board of Fire and Water Commissioners of Kansas City on contracts for additional water supply. The work will include pressure tunnels, reservoir, steel-pipe lines, motor-driven centrifugal pumps, electric motors, switchboard and electrical equipment, outdoor substation, filter and pumping stations, etc. Fuller & Maitland are engineers.

ASHLAND, NEB.—The property of the Ashland Light, Power & Mill Company has been acquired by the Illinois Power & Light Corporation, Chicago. Improvements are contemplated by the new owner, to cost about $50,000.

OMAHA, NEB.—The City Council plans to extend the ornamental lighting system on Douglas Street from Twelfth to Twentieth Street.

O'NEIL, NEB.—Extensions and improvements are contemplated by the Minnesota Electric Distributing Company, Minneapolis, to its local plant, to cost about $40,000. The proposed work will include the installation of a 300-hp. Diesel engine, directly connected to a 200-kw. generator, and remodeling the power house to provide for the new equipment.

KANSAS CITY, KAN.—The City Council is considering the installation of electrically operated pumping machinery in the municipal waterworks, to cost about $200,000. R. L. McAlpine is engineer.

Southern States

COLUMBIA, S. C.—A permit has been granted the Broad River Power Company to erect a substation at the corner of Gervais and Gist Streets, to cost about $10,000.

SPARTANBURG, S. C.—Negotiations have been completed by the Blue Ridge Power Company for the purchase of electric power from the hydro-electric power plant to be built on the Rocky Broad River at Lure Lake by the Chimney Rock Mountain, Inc., for which contract has been awarded. Right-of-way has been secured by the Blue Ridge Power Company for the erection of a transmission line from the Turners Shoals power station to the site of the Lake Lure dam, a distance of 6½ miles. This line will furnish power for construction work, and when the work is completed will connect the two systems.

FAYETTEVILLE, GA.—The Common Council is considering the installation of an electric lighting system, to cost about $15,000.

CLEARWATER, FLA.—The City Council is considering the installation of electric lamps on South Fort Harrison Avenue from Jefford Street to the Atlantic Coast line.

DAYTONA, FLA.—The Daytona Highlands Company is arranging a fund of $50,000 for the installation of an electric lighting system and gas system on a local tract of land to be developed for residential service.

ORLANDO, FLA.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system.

PLANT CITY, FLA.—The Plant City Public Service Company is considering extensions and improvements in the street-lighting system.

VERO, FLA.—The Light and Water Department is considering the purchase of a motor-generator set, one 750-hp. Diesel engine, switchboard and accessory equipment for the municipal power station. A 10-ton, 50-ft.-span traveling crane will also be installed. Harry W. Damerow is manager.

MILAN, TENN.—The City Council is considering a bond issue of $50,000, the proceeds to be used for extensions and improvements in the municipal electric plant and waterworks.

SMITHVILLE, TENN.—The Tennessee Electric Power Company, Chattanooga, is reported to have acquired electric power lines and franchise from the city.

OPELIKA, ALA.—The Pepperill Manufacturing Company, Biddeford, Me., it is reported, plans to build a power house at its proposed local cotton mill.

COLUMBUS, MISS.—The Mississippi Power & Light Company, Jackson, contemplates the construction of a large steam power plant at Columbus.

PALMETTO, LA.—Plans for the proposed local sawmill to be erected by the Brewton-Nienstedt Lumber Company include a power house.

LAWTON, OKLA.—Preliminary plans are being prepared by the Southwest Light & Power Company for the erection of a transmission line from Frederick to Grandfield, to cost about $30,000. E. Ernsberger, Continental Building, Oklahoma City, is engineer.

ALVIN, TEX.—The plant and holdings of the Alvin Light & Ice Company have been purchased by the Western Public Utilities Company, Colorado Springs, Col.

CLAUDE, TEX.—Improvements are contemplated to the lighting system, to cost about $35,000. Gantt-Baker & Company, 1116 Main Street, Oklahoma City, Okla., are engineers.

DAYTON, TEX.—The plant of the Dayton Light & Power Company has been purchased by the Western Public Service Company, Colorado Springs, Col.

McALLEN, TEX.—All bids submitted for construction of college buildings and power house for Carroll College have been returned unopened. Revised plans are being prepared by H. P. Smith, architect, National Bank of Commerce Building, San Antonio.

NAVASOTA, TEX.—Plans are under way by the Western Public Service Company, Colorado Springs, Col., for the erection of a transmission line from Navasota to Sour Lake, a distance of about 100 miles.

Pacific and Mountain States

LONGVIEW, WASH.—The Puget Sound Light & Power Company, Seattle, plans to build a substation in Longview.

SEATTLE, WASH.—A resolution has been adopted by the City Council authorizing the installation of a street-lighting system on Fifth Avenue and Fifth Avenue South.

TACOMA, WASH.—The City Council has passed an ordinance for the installation of an improved street-lighting system on North E and G Streets, a portion of Tacoma Avenue, Grant Avenue and on Second Street.

LOS ANGELES, CAL.—The Pacific Railway Company plans to build a substation at 1630 East Twenty-sixth Street.

LOS ANGELES, CAL.—The City Council has approved an ordinance for the installation of an ornamental street-lighting system on Santa Barbara Avenue, from Main Street to Western Avenue, and on Alvarado Street, from the Glendale Boulevard to Sixth Street, using pressed-steel standards.

MONTEREY, CAL.—Property owners on Main Street have presented a petition to the City Council asking that all overhead wires be placed underground when the contract for improvement of the thoroughfare is awarded.

OAKLAND, CAL.—A petition has been presented to the City Council by property owners on Piedmont Avenue for the installation of an ornamental lighting system, maintained by underground wires on that thoroughfare from its intersection with Broadway to the Cemetery.

OROVILLE, CAL.—The Table Mountain and Thermalito Irrigation Districts have secured permission to construct a hydro-electric power plant on Concow Creek, Butte County, to develop 3,010 hp., to cost about $115,000.

SAN FRANCISCO, CAL.—Surveys have been completed by the Great Western Power Company for the erection of an emergency transmission line from the Caribou plant to the Las Plumas power house in Feather Canyon near Oroville.

SAN FRANCISCO, CAL.—The Pacific Gas & Electric Company plans to build a new automatic substation on Ocean Avenue, near Junipero Serra Boulevard, to supply electricity in the section adjacent to St. Francis Wood, Ingleside, Forrest Hill and Sunset. The station will be known as station "L" and will cost about $198,500.

STOCKTON, CAL.—Extensions and improvements are contemplated by the Western States Gas & Electric Company, to cost about $300,000, during 1925. The work will include extension of transmission lines in both city and rural districts, installation of a 10,000-kw. synchronous condenser, seven 3,333-kw. transformers, extensions to gas system, etc.

PROVO, UTAH.—Steps have been taken by the Chamber of Commerce to secure the installation of an ornamental lighting system in the business section.

YUMA, ARIZ.—The water-power owners of the Yuma irrigation project have voted to adopt the proposal to erect a power plant at Siphon Drop.

DENVER, COL.—Plans are under way by the Public Service Company of Colorado to double the output of its present power plant at Valmont, near Boulder, to cost about $750,000. The work will include the installation of a second generating unit, to cost about $750,000, and the construction of a main dam 3,500 ft. long with five subsidiary dams, to cost about $600,000.

Canada

VANCOUVER, B. C.—The American Can Company, 535 Railway Avenue, plans to install electric power equipment in connection with proposed extensions in its local plant, to cost about $1,000,000.

WINNIPEG, MAN.—The public utilities committee of the City Council has authorized an appropriation of $50,000 for extensions to the street-lighting system.

BRANTFORD, ONT.—The City Council has adopted a report of the fire and light committee calling for the installation of electric lamps on Maitland Street.

TORONTO, ONT.—Plans are under way for the construction of a steam plant for the generation of electricity, to cost about $5,000,000, by the Ontario Hydro-Electric Power Commission. It is proposed to equip the plant for supplying heat to the business section of Toronto.

Electrical Patents

Announced by U. S. Patent Office

(Issued January 13, 1925)

1,522,657. MAGNETIC SOUND BOX FOR PHONOGRAPHS AND THE LIKE; Curt Stille, Berlin-Zehlendorf, Germany. App. filed June 3, 1922.

1,522,665. ELECTRIC FURNACE AND METHOD OF OPERATING THE SAME; Parvin Wright, Chicago, Ill. App. filed Feb. 16, 1922. Using an arc electrode and a secondary circuit (inductive), including a resistor.

1,522,670. SELF-WINDING ELECTRIC CLOCK; Ferdinand Busse, Berlin, Germany. App. filed Dec. 11, 1923.

1,522,694. TESTING SET; Lester L. Neal, Hoquiam, Wash. App. filed Oct. 11, 1921. For lamps and battery cells of different sizes and shapes.

1,522,713. CIRCUIT-CONTROLLING SWITCH; Howard L. Coyner, Brooklyn, N. Y. App. filed April 13, 1922. Interrupter.

1,522,719 STORAGE BATTERY; William S. Gould. New York, N. Y., and Raymond A Klock, Closter, N. J. App. filed June 5, 1924. Portable type, for use as plate battery in radio apparatus.

1,522,728 EMERGENCY CLAMP FOR STORAGE BATTERIES; Benjamin Krohn, Cleveland, Ohio. App. filed Dec. 7, 1921.

1,522,729. FUSE BLOCK; Warren P. Loudon; Wilkinsburg, Pa. App. filed March 24, 1921.

1,522,732 LIGHTING FIXTURE; Wilfrid Lumley Conneaut, Ohio. App. filed Dec. 16, 1921. Indirect type.

1,522,734. TRANSFORMER CASE; Walter V. McLin, Toledo, Ohio. App. filed June 4, 1923. Bell-ringing type.

1,522,735. ELECTRICAL MEASURING INSTRUMENT; Paul MacGahan, Pittsburgh, Pa. App. filed March 1, 1920. Frequency meter.

1,522,736. ELECTRICAL MEASURING INSTRUMENT; P. MacGahan, Pittsburgh, Pa. and Raymond T. Pierce, East Pittsburgh, Pa. App. filed Oct. 11, 1923. Coil-supporting means.

1,522,737. PARTY-LINE MEASURED-SERVICE TELEPHONE SYSTEM; Talbot G. Martin, Chicago, Ill. App. filed Nov. 5, 1919.

1,522,742. ADJUSTABLE-SPEED ALTERNATING-CURRENT MOTOR; Edward G. Parvin, Roselle, N. J. App. filed Jan. 26, 1921. Induction type, with two or more magnetic fields rotating at different angular velocities about the motor axis.

1,522,743. STORAGE BATTERY; Ward B. Pettibone, Cleveland, Ohio. App. filed May 26, 1919. Cell mounting.

1,522,745. BALANCED ANTENNA SYSTEM; Abraham Press, Wilkinsburg, Pa. App. filed June 17, 1920. Wireless transmission systems.

1,522,746. FLASHLIGHT; Raymond Prew, Boston, Mass. App. filed May 13, 1924.

1,522,747, 1,522,748. MAGNETO; Adolph Rosner, Springfield, Mass. App. filed Dec. 7, 1921. Oscillating type.

1,522,758. TELEPHONE DIAPHRAGM; Phillips Thomas, Pittsburgh, Pa. App. filed April 18, 1922. Corrugated type.

1,522,766. SELECTIVE SWITCH; Gustav O. Wilms, Milwaukee, Wis. App. filed April 3, 1922. Contact make-and-break type for use with magnetic switches.

1,522,786. THERMAL RELAY; John B. MacNeil, Wilkinsburg, Pa. App. filed June 9, 1920.

1,522,807. ELECTRICAL SIGNALING; Louis Cohen, Washington, D. C. App. filed Jan. 16, 1922. Radio signaling.

1,522,814. TELEPHONIC CONVERSATION METER; Robert Ferry, Paris, France. App. filed Jan. 6, 1921.

1,522,818. ELECTRIC TOASTER; Aage Groueff and Harold A. Holmes, Chicago, Ill. App. filed Dec. 26, 1922.

1,522,838. ELECTRIC SADIRON; Matthew Reh and John Reh, Salina, Kan. App. filed Sept. 26, 1922. With current-flow indicator.

1,522,855. ELECTRICAL TESTING SYSTEM; Arnold S. Bertels, Highwood, N. J. App. filed Oct. 23, 1922. For circuits and apparatus in automatic telephone stations.

1,522,856. TESTING DEVICE FOR TELEPHONE-EXCHANGE SYSTEMS; Arnold S. Bertels, Tenafly, N. J. App. filed Nov. 6, 1922.

1,522,861. EVEN-HEAT ELECTRIC IRON; Leroy R. Bowles, Hollywood, Cal. App. filed Dec. 8, 1921.

1,522,862. TELEPHONE SYSTEM; Langford J. Bowne, Howard Beach, N. Y. App. filed Sept. 7, 1922. In which toll-switching trunks are employed to establish telephone connections between distant subscribers.

1,522,865. SIGNALING SYSTEM; Allison A. Clokey, Rutherford, N. J. App. filed Nov. 29, 1921. Providing synchronously operated means for relaying or repeating signal-current impulses from one circuit to another.

1,522,875. TELEPHONE-EXCHANGE SYSTEM; Clarence B. Fowler, New York, N. Y. App. filed Sept. 8, 1920. Including manual and automatic exchanges.

1,522,882. METHOD OF AND SYSTEM FOR SELECTIVE ENERGY TRANSMISSION; John H. Hammond, Jr., Gloucester, Mass. App. filed March 16, 1912. Using carrier current.

1,522,883. POLYPULSE SYSTEM OF CONTROL; John H. Hammond, Jr., Gloucester, Mass. App. filed June 16, 1917. Receiving system for radiant energy.

1,522,893. TELEPHONE SYSTEM; Alben E. Lundell, New York, N. Y. App. filed Oct. 24, 1919. Machine switching.

1,522,905. TELEPHONE-EXCHANGE SYSTEM; Lipa Polinkowsky, Antwerp, Belgium. App. filed Jan. 19, 1922. Machine switching.

1,522,911. DIMMER SYSTEM; Charles C. Robinson, Richmond, Va. App. filed March 19, 1924. For actuating dimmer switches singly and in groups.

1,522,926. ELECTRIC TERMINAL CABINET; George B. Wadsworth, Covington, Ky., App. filed Aug. 7, 1922. For housing the meter blocks.

1,522,930. TELEPHONE-EXCHANGE SYSTEM; Samuel B. Williams, Brooklyn, N. Y. App. filed Oct. 31, 1923. Automatic.

1,522,936. SWIVEL; Calvin S. Baker, Portland, Ore. App. filed Oct. 2, 1923. For use in drop cords.

1,522,939. CONTROLLER FOR TRAIN-SIGNAL SYSTEMS; William E. Benn and George E. Davies, Troy, N. Y. App. filed May 10, 1920.

1,522,942. INCANDESCENT ELECTRIC LAMP FIXTURE; Thomas B. Cabell, Jackson, Miss. App. filed Feb. 12, 1924. Adjustable; especially applicable to street lighting.

1,522,964. ELECTRODE-CLAMPING DEVICE FOR ELECTRIC WELDING MACHINES; Joseph W. Meadowcroft, Philadelphia, Pa. App. filed Aug. 16, 1921.

1,522,986. INDICATING INSTRUMENT; Hamilton D. Taylor, Schenectady, N. Y. App. filed July 21, 1924. For measuring small, rapid movements as vibrations.

1,522,987. INSULATED CONDUCTOR; Harry W. Turner, Schenectady, N. Y. App. filed March 2, 1923. For conductors with prismatic cross-section.

1,522,988. TIME SWITCH; Henry E. Warren, Ashland, Mass. App. filed Oct. 27, 1920.

1,522,991. SOCKET; Frederick H. Weston, Schenectady, N. Y. App. filed Oct. 4, 1918. For use with high-voltage, large-capacity incandescent lamps.

1,522,992. IMMERSION HEATER; Charles C. Abbott, Pittsfield, Mass. App. filed June 16, 1922.

1,522,993. RESISTANCE LINE WELDING; Peter P. Alexander, Lynn, Mass. App. filed Dec. 20, 1922. Using low-frequency currents to produce the weld.

1,523,004. DYNAMO-ELECTRIC MACHINE; Robert E. Doherty, Scotia, N. Y. App. filed Nov. 21, 1923. With commutating field.

1,523,011. CONTINUOUS WAVE-TRANSMISSION SYSTEM; William E. Garity, New York, N. Y. App. filed Sept. 23, 1920.

1,523,013. METHOD OF PRODUCING A CONDUCTIVE PATH BETWEEN SPACED ELECTRICAL CONDUCTORS; Grover R. Greenslade, Pittsburgh, Pa. App. filed May 24, 1922. As in a vacuum tube.

1,523,019. FLUID-HEATING-CONTROL SYSTEM; Morris Kasser, San Francisco, Cal. App. filed Nov. 24, 1923.

1,523,029. ELECTRODE ELEMENT FOR GALVANIC BATTERIES AND METHOD OF PRODUCING SAME; Martin L. Martus, Woodbury, Conn. App. filed Feb. 8, 1922.

1,523,030. MAGNETO; Carl A. Mayer and Adolph Rosner, Springfield, Mass. App. filed July 28, 1921.

1,523,036. TESTING MECHANISM FOR AUTOMATIC SWITCHES; Herbert F. Obergfell, River Forest, Ill. App. filed Aug. 31, 1921.

1,523,037. SIGNALING CIRCUIT; Donald A. Quarles, Englewood, N. J. App. filed Oct. 26, 1922.

1,523,054. ELECTRIC SWITCH; John A. Crabtree, Erdington, Birmingham, England. App. filed March 20, 1924. Tumbler type.

1,523,075. ELECTRIC FUSE; William B. LaPointe, Columbus, Ohio. App. filed Oct. 2, 1922. Renewable.

1,523,099. PULL-CHAIN SOCKET; Joseph Askins, Chicago, Ill. App. filed March 24, 1923.

1,523,101. PANELBOARD; Reuben B. Benjamin, Chicago, Ill. App. filed June 14, 1920. With standard and interchangeable units.

1,523,102. RECEIVING CIRCUIT; Walter L. Betts, Brooklyn, N. Y. App. filed Dec. 30, 1922. Where high-power amplifiers are used.

1,523,103. METHOD OF OBTAINING METALS FROM THEIR RESPECTIVE OXIDES OR ORES; Alexander L. Duval D'Adrian, Washington, Pa. App. filed March 12, 1920. Using an arc furnace.

1,523,109. MAGNETIC MATERIAL; Gustaf W. Elmen, Leonia, N. J. App. filed Dec. 21, 1920. Magnetic alloys.

1,523,111. SIGNALING SYSTEM; Harold J. Fisher, Jersey City, N. J. App. filed Dec. 5, 1923. Radio-telegraph system.

1,523,125. FUSE PLUG; Oscar H. Jung, Milwaukee, Wis. App. filed May 8, 1922. Socket type; non-renewable.

1,523,127. MULTIPLEX-SIGNALING SYSTEM; Burton W. Kendall, New York, N. Y. App. filed Oct. 2, 1920.

1,523,139. HIGH-FREQUENCY SIGNALING; Eugene Peterson, New York, N. Y. App. filed Dec. 15, 1923.

1,523,144. FOCUSING SOCKET; Newton L. Snorf, Chicago, Ill. App. filed June 3, 1922.

1,523,149. MEANS FOR CONTROL OF ELECTRIC IMPULSES; Edmund B. Wheeler, New York, N. Y. App. filed Nov. 15, 1923. As means for indicating time intervals.

1,523,156. ELECTRICALLY ENERGIZED FAUCET HEATER; Leslie M. Adams, Seattle, Wash. App. filed July 5, 1923.

1,523,164. INSULATOR-SUPPORTING BRACKET; Thomas H. Barnard and Herbert M. Taylor, Brighton, Ontario, Canada. App. filed Feb. 18, 1921. For distribution work.

1,523,166. CURRENT INTERRUPTER; Charles E. Bennett, Atlanta, Ga. App. filed June 24, 1919. For use with lightning arrester.

1,523,193. AUTOMATIC FILAMENT CONTROL FOR WIRELESS APPARATUS; Arne Gudheim, Blacksburg, Va. App. filed Nov. 21, 1921.

1,523,198. CLUSTER ELECTRIC SOCKET; Max Herskovitz, Chicago, Ill. App. filed Jan. 26, 1921.

1,523,262. SOUND-PRODUCING APPARATUS OR ELECTROMAGNETIC RECEIVING OR EMITTING DEVICE; Maurice Gueritot, Paris, France. App. filed April 12, 1922.

1,523,266. ELECTRIC CIRCUIT BREAKER AND THE LIKE; Bruce H. Leeson, Tynemouth, England. App. filed March 13, 1924. Intended to open very quickly a circuit under heavy load.

1,523,299. METHOD FOR REDUCING CROSS-TALKING IN TELEPHONE PHANTOM LINES; Eugen Schurer, Cologne-Mulheim, Germany. App. filed Dec. 8, 1923.

1,523,301. MULTIPLE CIRCUIT SWITCH; Walter J. Spiro, White Plains, N. Y. App. filed Sept. 8, 1921. For vehicle control.

1,523,349. MOVABLE COIL FOR ELECTRODYNAMIC RECEIVERS; Edwin S. Pridham and Peter L. Jensen, Oakland, Cal. App. filed May 10, 1922.

1,523,362. INCANDESCENT ELECTRIC LAMP; John C. Shedd, Eagle Rock City, Cal. App. filed Nov. 13, 1918. Multiple filament using an automatic electromagnetic switch for substituting an unused filament for a burnt-out filament.

1,523,367. HIGH-TENSION TRANSFORMER; Waldemar Petersen, Darmstadt, Germany, Friedrich Dessauer, Frankfort-on-the-Main, Germany, and Eduard Welter, Darmstadt, Germany. App. filed April 9, 1921. Using a plurality of transformers whose high-tension windings are connected in series.

1,523,371. SIGNAL DEVICE; Joseph O. Cadieux, Meriden, Conn. App. filed July 2, 1923. Circuit-controlling device for hospital signal systems, etc.

1,523,377. RADIOTELEGRAPH SYSTEM; John B. Brady, Somerset, Md. App. filed Aug. 14, 1923. Automatic.

1,523,378. STATIONARY INDUCTION APPARATUS; Thomas C. Lennox, Pittsfield, Mass. App. filed Oct. 26, 1920. Air-blast transformers.

1,523,380. CONNECTOR SWITCH AND BANK CONTACT; Frank A. Lundquist, Chicago, Ill. App. filed Oct. 22, 1920. For automatic telephone exchanges.

1,523,381. TRUNK-SELECTING DEVICE; Frank A. Lundquist and John A. Kropp, Chicago, Ill. App. filed Nov. 22, 1920. For use in an automatic telephone system.

(Issued January 20, 1925)

15,987 (reissue). CONTROL APPARATUS; E. F. Northrup, Princeton, N. J. App. filed Feb. 16, 1909. Actuated in response to changes in temperature.

1,523,383. SELECTOR; A. H. Adams, Lakeville, Conn. App. filed May 5, 1922. For use in telephone systems.

1,523,385. SWITCHING DEVICE; G. F. Atwood, Newark, N. J. App. filed June 27, 1922. Driving arrangement adapted for use with panel-type switches as used in telephony.

Financial and Corporate

Market Is Irregular

Narrow Price Movement Appears in Week of Moderate Trading

THE past week in general was an uneventful one so far as the listed or unlisted markets in power and light stocks were concerned. Following somewhat the behavior of prices on the New York Stock Exchange for the larger list, utility values revealed a movement that was characterized by irregularity but with net changes for the week relatively small. Stocks became somewhat weak during one session and rallied slightly during another. American Power & Light sold as low as 55 during the week, but closed around its level of a week ago.

Continued heavy trading in Electric Investors, Inc., has made the two issues under that caption prominent in the trading again, but, as was the case a week ago, when the 10-per-cent-paid stock touched 31, it moved off a point or so. Commonwealth Power Corporation has been holding at or just below 120 recently, and the warrants fell to a new recent low last week of 37 on the curb market. American Water Works & Electric on announcement of the declaration of an initial dividend of 30 cents per share for the quarter, or at the rate of $1.20 a year on the new stock, fell to 35 and since then has held between 35 and 36 and a fraction rather persistently. National Power & Light and Lehigh Power Securities had periods both of decline and recovery.

On announcement of the bankers that the Northern Ohio Electric Corporation's plan of reorganization had become operative the securities of the new company, the Northern Ohio Power Company, became distinctly stronger. The new stock on a "when issued" basis sold in sizable blocks above 7, the bonds sold close to 80 and the options between 5 and 6.

Report of Cleveland Electric Illuminating Company

Substantial increases in earnings and surplus, as well as in capital stock, dividends paid stockholders and customers served, are shown in the annual report of the Cleveland Electric Illuminating Company. The company's earnings for the year ended December 1 totaled $18,229,295, an increase of $710,125 over 1923. A surplus of $3,137,282 remained after paying $2,048,520 in dividends, compared with $2,431,828 after paying $1,840,592 in dividends the year before. An increase of about $7,000,000 in capital stock was made during the year, while the funded debt expanded $11,500,000. The balance sheet shows the company with nearly $18,000,000 of working capital.

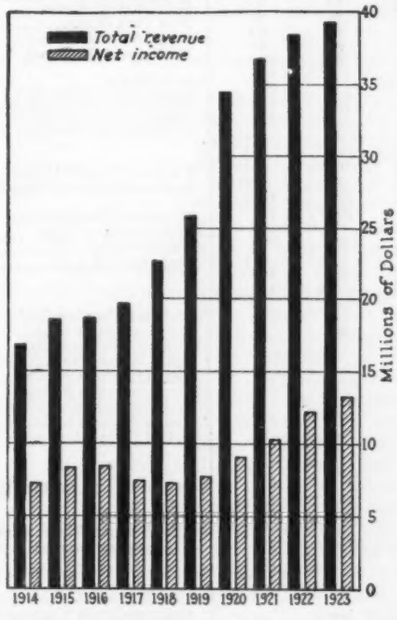
"The year was one of growth, development and progress," President Robert Lindsay said in his statement to stockholders. "Expenditures for betterments and extensions exceeded $9,500,000. The territory served was extended, plant capacity was increased, efficiencies of operation were effected, and the number of stockholders served increased about 7,000. The company added 80,000 hp. to its electric generating facilities, completed its high-tension line connecting the northern and eastern Ohio superpower system, built seven substations, completed the first unit of its central steam-heating station and added 14,889 customers. Kilowatt-hours generated totaled 865,079,266, an increase of 7.7 per cent."

Pacific Gas & Electric Company

Its Gross Earnings Have Doubled Within the Last Six Years, and Its Business Dates Back to the Birth of the Light and Power Industry

BY PAUL WILLARD GARRETT

THE Pacific Gas & Electric Company does, as the name suggests, both a gas and an electric business. The gas business of the company or its predecessors dates back to a decade before the Civil War, and the electric business dates back approximately four decades, or to about the time of the birth of the light and power industry. The proportions of the total income contributed by the two major departments have varied, but as now organized the company derives roughly 60 per cent of its gross revenues from its electric service and 35 per cent from the sale of artificial gas.



PERSISTENT GROWTH IN GROSS REVENUES OF PACIFIC GAS & ELECTRIC COMPANY

In the long period that the company's electric and gas departments have been organized in some form, they have, as President W. E. Creed recently said, "been in continuous and successful operation." Growth has been particularly rapid during the last decade, however, the rate of growth having been accelerated to such an extent that the company within the last six years has about doubled its volume of gross business. In 1914 gross revenues totaled $16,912,688, but by persistent yearly gains gross reached $22,595,517 by 1918 and $42,317,645 by the twelve months ended June 30, 1924. Net earnings have improved in the same persistent and impressive manner, the figure having risen from $7,306,582 for 1914 to $7,375,388 for 1918 and to $16,457,402 for the twelve months ended June 30, 1924.

The interesting thing from the standpoint of investors is that while interest charges have increased along with gains in the amount available for fixed charges, net has grown faster relatively than have the company's interest requirements. The result of this is that the balance shown after interest charges has widened by steady gains from $4,616,131 in 1917 to $10,182,330 for the twelve months ended June 30, 1924. The company for a period of years has been earning its interest requirements substantially more than twice.

ANALYSIS OF CAPITAL STRUCTURE

Representing an invested capital of $251,221,344, the Pacific Gas & Electric Company has $153,961,100 in bonds and $97,260,244 in stocks. The company has something like $41,676,700 in underlying bonds closed at the amounts now outstanding. The two Pacific Gas & Electric bond issues that investors know best are the general and refunding mortgage 5's of 1942, which are outstanding to the amount of $35,822,000, and the first and refunding mortgage bonds, of which three series now are outstanding.

The company's stock is divided in a fairly even manner as between preferred and common. Curiously enough, while the company was a pioneer in the customer-ownership movement to sell preferred stocks, it is taking a lead at the present time in the movement to sell common stocks in its territory. The Pacific Gas & Electric Company during the last year offered 50,000 shares of common stock under the customer-ownership campaign. Sales of common were made in large blocks at $93 per share. The company pays 6

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stocks is $100.

Companies	Bid Price Saturday, Jan. 31	Low 1925	High 1925
PREFERRED STOCKS			
Operating Companies			
Adirondack Power & Light 7 per cent	99	98	101
Appalachian Power, 7 per cent	96	92	100
Arkansas Light & Power 7 per cent	92	92	96
Asheville Power & Light 7 per cent	*a* 99	99	100
Central Illinois Public Service 6 per cent	84½	84	87
Colorado Power 7 per cent	93	93	98
Connecticut Light & Power 7 per cent	105	105	110
Consumers' Power 6 per cent	90	90	93
Dayton Power & Light 6 per cent	93	88	100
Duquesne Light 7 per cent	*a*107	105	107
Eastern Texas Electric 6 per cent	100	100	105
Empire District Electric 6 per cent	78	78	85
Fort Worth Power & Light 7 per cent	*a*101	100	102
Great Western Power 7 per cent	97½	...	...
Illinois Northern Utilities 6 per cent	84	82	87
Illinois Power & Light 7 per cent	94	92½	98
Kansas Gas & Electric 7 per cent	*a* 98	98	100
Long Island Lighting 7 per cent	102	100	105
Minnesota Power & Light 7 per cent	*a* 96	96	98
Mississippi River Power 6 per cent	87½	87½	90
Nebraska Power 7 per cent	*a* 98	98	100
Niagara Falls Power 7 per cent—25	28	28	29
Niagara, Lockport & Ont. Power 7 per cent	106	101½	108
Northern States Power 7 per cent	95½	95	98
Ohio Public Service 7 per cent	97½	97	100
Pacific Gas & Electric 6 per cent	95	92	97
Pacific Power & Light 7 per cent	*a* 98	98	100
Penn-Ohio Power & Light 7 per cent	91	91	96
Pennsylvania Power & Light $7—no par	*a*101	100	101½
Penn. Public Service 7 per cent	90	90	100
‡Philadelphia Electric 8 per cent—25	40¼	40	44¼
Southern California Edison 8 per cent	115	115	120
Tennessee Electric Power, 6 per cent	80	80	82½
Texas Power & Light 7 per cent	*a*100	100	101
Utah Power & Light 7 per cent	*a* 98	97	99
Western States Gas & Electric 7 per cent	82	82	85
Yadkin River Power, 7 per cent	*a* 99	98	100
Holding Companies			
American Gas & Electric 6 per cent—50	45½	45½	47½
American Light & Traction	93½	93	95½
American Power & Light 6 per cent	87	86	90
American Public Service 7 per cent	88	88	92
American Public Utilities 7 per cent	87	87	95
American Water Works & Electric 7 per cent	*a* 99	95½	99
Associated Gas & Electric 7 per cent—1 per cent extra—50	50	...	...
Carolina Power & Light 7 per cent	100	100	105
Central Indiana Power 7 per cent	88	88	93
Cities Service 6 per cent	80	80	81½
Commonwealth Power 6 per cent	80	80	82½
Consolidated Gas 6 per cent—50	57½	57½	58½
Continental Gas & Electric 7 per cent pr. pf.	89½	89	92½
Electric Bond & Share 6 per cent	102	102	103¼
General Gas & Electric—$8—no par	105	104½	108
*Middle West Utilities 7 per cent	92	90	94
National Power & Light—$7—no par	96	95	98
North American 6 per cent—50	*a* 47	46½	47½
Public Service Corp. of N. J. 7 per cent	101	99	102
Public Service Corp. of N. J. 8 per cent	*a*112	110	112½
Standard Gas & Electric 8 per cent—50	50	49	52
†United Gas Improvement—50	57½	57	58
United Light & Power—$6.50—no par	85	83	88
COMMON STOCKS			
Operating Companies			
Adirondack Power & Light—50	33	33	38
Appalachian Power—no par	74	74	83
Arkansas Light & Power	65	65	70
Brooklyn Edison	128	120½	133
Buffalo General Electric	197	197	199
*Commonwealth Edison	133	132	135
§Consolidated Gas, Electric Light & Power	*a* 33	32	34
Dayton Power & Light	190	180	210
Detroit Edison	*a*114½	110	115
|| Edison Electric Illuminating of Boston	*a*200½	...	...
Kentucky Hydro Electric	*a* 90	85½	90
Long Island Lighting	200	...	...
Mississippi River Power	37	37	40
Montana Power	70	68	72
Niagara Falls Power—no par	46	43	48
Niagara, Lockport & Ontario Power—no par	67	63	69
Northern Ohio Power	6	5	7½
Northern States Power	104½	103	107
North Texas Electric	64	64	67
Pacific Gas & Electric	*a*104	102½	104½
§Pennsylvania Water & Power	126	120	130
‡Philadelphia Electric—25	42½	40	44¾
*Public Service Co. of Northern Illinois	97	97	100
Puget Sound Power & Light	53	53	58
Southern California Edison	103	102	106
Tennessee Electric Power—no par	50	50	61
Virginia Power	75	75	92
West Penn. Co.	115	110	119
Holding Companies			
American Gas & Electric—no par	75½	72	80
American Light & Traction	144½	139	147
American Power & Light	56	55	57
American Public Utilities	75	75	85
American Water Works & Electric	*a* 36	34¾	39½
Carolina Power & Light—no par	315	310	335
Cities Service	190	172	192
Columbia Gas & Electric—no par	*a* 48¾	45¾	49½
Commonwealth Power Corp.—no par	117	116	126
Consolidated Gas—no par	*a* 77½	75¾	78
Continental Gas & Electric	80	80	87
Federal Light and Traction	*a*135	114½	137
General Gas & Electric	78	77	81
Lehigh Power Securities—no par	106	105	116
*Middle West Utilities—no par	87	84	90
National Power & Light—no par	189	185	230
North American—10	*a* 42½	41½	44
Philadelphia Co.—50	*a* 53½	53	57½
Power Securities—no par	18	...	...
Public Service Corp. of N. J.—no par	*a* 70½	67½	72
Standard Gas & Electric—no par	*a* 43½	40½	46
United Gas & Electric (Conn.)—no par	32	32	37½
Utah Securities	*a* 49½	42	53
BONDS			
Operating Companies			
Adirondack Power & Light 6s	1950	102½	102½ 103½
Alabama Power 5s	1946	96½	96 97
Appalachian Power 5s	1941	96½	96 97
Brooklyn Edison 5s	1949	*a* 99½	99½ 99½
6s	1930	104½	104½ 104½
Cleveland Electric Illuminating 5s	1939	100½	100 101½
Commonwealth Edison 5s	1943	100	99½ 100½
5s	1953	98½	98½ 99½
§Consol. Gas, Elec. Lt. & Pwr. 4½s	1935	95½	95½ 96½
6s	1949	*a*105½	104½ 105½
Consumers' Power 5s	1936	99	99 99½
5s	1952	*a* 93½	90½ 93½
Detroit Edison 5s	1933	*a*102	100 102
Duquesne Light 6s	1949	*a*106	105 106½
Great Western Power 5s	1946	95½	95 96
Kansas City Power & Light 5s	1952	*a* 97½	95½ 97½
Mississippi River Power 5s	1951	97	96½ 97½
Montana Power 5s	1943	*a* 99½	97½ 99½
New England Power 5s	1951	100½	100½ 101½
New York Edison 6½s	1941	*a*114½	112½ 114½
Niagara Falls Power 6s	1950	105	105 106½
Northern States Power 5s	1941	*a* 94½	93 94½
6s	1941	*a*103½	103 105½
Ohio Power 7s	1951	106½	106½ 107½
Pacific Gas & Electric 5s	1942	*a* 94½	93½ 95
Pennsylvania Water & Power 5s	1940	100	99½ 100½
‡Philadelphia Electric 5s	1966	100⅜	100½ 102
5½s	1947	104½	103½ 104½
6s	1941	106½	106 106½
Portland Electric Power 6s	1947	98	94 98
Southern California Edison 5s	1939	99½	99½ 100
6s	1944	102½	102½ 103½
Tennessee Electric Power 6s	1947	100½	99½ 101
Texas Power & Light 5s	1937	97½	97 98
Toledo Edison 7s	1941	109½	108½ 109½
Utah Power & Light 5s	1944	92½	91 92½
Holding Companies			
Alabama Traction, Light & Power 5s	1962	86	86 87½
American Gas & Electric 6s	2014	96½	96½ 97
American Power & Light 6s	2016	94½	94 95
Amer. Water Works & Electric 5s	1934	94½	92½ 94½
Central Indiana Power 6s	1947	97½	95½ 97½
Commonwealth Power 6s	1947	99½	97½ 100
Consolidated Cities Lt., Pwr. & Tr. 5s	1962	75	75 76½
Illinois Power & Light 6s	1953	100½	100½ 101½
United Light & Railways 5s	1932	95	93½ 95
6s	1952	97½	95½ 97½
ELECTRICAL MANUFACTURING COMPANIES			
PREFERRED STOCKS			
Allis-Chalmers Manufacturing	106	103½	107
Worthington Pump & Machinery A	*a* 86½	85	88
COMMON STOCKS			
Allis-Chalmers Manufacturing	*a* 76¾	71½	82¾
American Bosch Magneto—no par	*a* 40½	33	54½
Electric Storage Battery—no par	*c* 65¾	62¼	70¾
General Electric	*a*249½	241½	320
General Electric—10	*a* 11½	11	11½
*Hurley Machine—no par	*a* 51½	50	56
†Wagner Electric	39⅝	26½	47½
Westinghouse Electric & Manufacturing—50	*a* 74½	71¾	84
Worthington Pump & Machinery	*a* 68	62½	79¾
BONDS			
Canadian General Electric 6s	1942	107¾	107½ 107½
General Electric 3½s	1942	84½	83 84½
5s	1952	102	101½ 105½
Robbins & Myers 7s	1952	70½	67 73½
Western Electric 5s	1944	98½	98½ 99
Westinghouse Electric & Mfg. 7s	1931	108½	107½ 108½

*Chicago Stock Exchange. †St. Louis Stock Exchange. ‡Philadelphia Stock Exchange. || Boston Stock Exchange § Baltimore Stock Exchange.
a Bid price Tuesday, February 3.

per cent cumulative dividends on its preferred stock and 8 per cent dividends on the common.

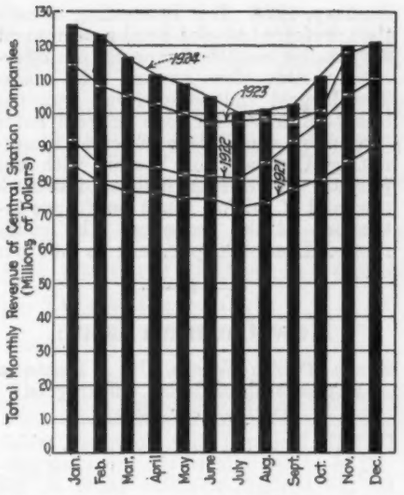
In the ten years ended June 30, 1924, the Pacific Gas & Electric Company expended for construction and the acquisition of new properties, together with the increase of net working assets, about $118,930,000, a figure that is more than twice the increase of $59,045,000 in funded debt during that period.

On the basis of present market quotations the company shows an equity above its funded debt of something like $90,000,000, represented by its outstanding preferred and common stock.

Central-Station Revenue Continues to Increase

Reports received by the ELECTRICAL WORLD from central-station companies representing approximately 74 per cent of the generator rating of the country indicate that the total gross revenue from the sale of energy during November was $120,100,000, or a daily average of $4,003,000, an increase of 6.8 per cent over November of last year.

Following the usual seasonal trend, the revenue during the month of November showed a material increase over that reported for October. Every section of the country reported an increase in revenue over that recorded for the same month of the previous year. The operating expenses during November amounted to $51,100,000 as compared with $48,500,000 for November, 1923.



GROSS REVENUE FOR LAST NOVEMBER 6 PER CENT OVER NOVEMBER, 1923

Responsibilities of Customer Ownership

Any Failure in the Payment of Dividends May Reflect on the Industry and Lead to Complications and Financial Embarrassment

BY RALPH S. CHILD
With Bonbright & Company, Ltd., Investment Bankers, New York

THE method of financing commonly known as "customer ownership" has been so generally taken up by public utility companies and with such marked success that sight may be lost of the elements of danger attending this kind of financing.

Statistics on "customer ownership" sales show that the great majority of sales are made to people of small or moderate means who have had little or no previous experience in the matter of investment. They are "sold," as a rule, through the personal contact of some employee of the public utility company and on the strength of a 6½ or 7 per cent return and because of the ease with which the stock may be purchased on the partial-payment plan. These buyers of stock know little about earnings statements or balance sheets —little about property values, rate of return or margin of safety. In fact, many companies in their "customer ownership" campaigns never show an earnings statement, the meaning of it not being understood by the average stock purchaser. The customer generally becomes a stockholder or "partner in the business" through sales persuasion and the fact that the investment is a local one and that the local banker speaks well of it.

It goes without saying that the investment banker, interested in the senior securities of public utilities, has been most favorably impressed with the development of "customer ownership." Naturally the placing of this equity back of the senior securities improves just that much the position of the senior securities that the banker has marketed to the public. This may be looked upon as a selfish viewpoint on the part of the investment banker.

However, it may be said that the investment banker with a broad view of the public utility business recognizes in the "customer ownership" movement something of value beyond that of added equity. He sees the growing list of customers who are "partners in the business" making for improved public relations for the utility. He sees that this experience in investment may well develop among these customers habits of thrift which can be of national benefit, and he sees an improved understanding on the part of utility employees of the problems of their local company in the conduct of its business and of the importance of their company's position in the economic life of their community. These factors mean a great deal and are looked upon by the investment banker as elements that will give added strength to the position of public utilities in the coming years.

The banker does see, however, certain other angles to the question of "customer ownership" which from his viewpoint are equally important, though perhaps not held quite so clearly in mind by the public utility companies themselves.

It is generally recognized that there is a definite responsibility upon a public utility to give good service. But, while every effort may be made to give good service, if through some physical condition over which there is no control the service should fail temporarily, nothing more serious as a rule results than a temporary inconvenience to the patrons. This particular kind of responsibility is one thing. However, the responsibility assumed by the company when it, through its own employee organization and its own representations, sells stocks in its enterprise to its customers is of quite another character. That utility company has invited its customers to become partners in its business and has taken on a definite responsibility which cannot be shirked or evaded, if through a succession of circumstances something should occur to impair the value of the investment and make necessary the cessation of dividends.

Obviously, in the sale of senior securities there are safeguards, such as a mortgage lien on the property and a claim on earnings prior to dividends, which are not enjoyed by the investor in preferred stock. It is vitally necessary to the continuance of the strong position of the public utility industry that there be no failure in the payment of dividends on the part of any company which has sold preferred stock to its customers. Should such a failure occur, it would reflect on the entire industry and might bring about complications which would be very far-reaching and possibly have disastrous results.

It might be added that it has been noticeable in some quarters that, in view of the readiness with which stock has been sold to customers by almost every public utility company which has undertaken this kind of financing, the public utility managements have naturally been much pleased with themselves because of the ease with which this financing has been accomplished. Perhaps they have not taken sufficiently into consideration the fact that the success of their initial campaign was due to a considerable extent to the fact that the people to whom sales were made were new investors, who as a rule put in money out of earnings instead of out of surplus funds, and that the employee organization entered into this work with energy and enthusiasm because it was a new and unusual job —one in which the spirit of competition and personal accomplishment counted in the success of the campaign.

KEEPING FAITH WITH INVESTORS

Again may I emphasize that the problems of the daily operation of a public utility, from the standpoint alike of the running of the plant, the handling of the public and the giving of service, are one thing. The problems that are added to the conduct of the business through the selling of stock and thus taking in customers as investor-partners in the business are of another kind, and they are of such a character that they cannot be treated lightly but must receive serious thought and attention from the management if pitfalls are to be avoided. It is believed that the men of the electrical industry clearly recognize the importance of this, and reference to the question is made here merely as a reminder. Perhaps questions of this kind are more

constantly in the minds of the investment banker because he is daily dealing with investment securities of many kinds and classes and because the questions of security and regular and constant payment of interest are ever before him in the matter of the securities he distributes to the public.

Allis-Chalmers Reports Successful Year

The Allis-Chalmers Manufacturing Company reports net profit for the year 1924 amounting to $3,221,100, an increase of $517,464, or approximately 19 per cent, over that reached in 1923. This net profit, after satisfying the preferred, is equivalent to a little more than $8 per share on the common stock, whereas in 1923 the balance remaining for the common was $6 per share. The year 1924 was the best the company has had since 1920, when the profits were $3,564,248. The 1924 results show an increase in billings of $2,242,815, or approximately 9 per cent over those of 1923. Unfilled orders on hand as of December 31, 1924, amounted to approximately $10,100,000.

January Security Issues Total $83,000,000

Eighteen Electric Light and Power Companies Participate in Financing of First Month of Year

DURING the month of January new issues of electric light and power securities, including stocks, bonds and notes, amounted to $83,400,000, a total representing the slight decrease of $1,011,100 under that of the preceding month, December, 1924, but an increase of $25,806,000 over that recorded for January, 1924. It is interesting to note that preferred stock played a prominent part in the month's financing, ten offerings of this class having been made. The largest individual issue was the thirty-million-dollar loan of gold notes floated by the Edison Electric Illuminating Company of Boston with the purpose of retiring floating indebtedness and of raising funds for future extensions of the property. The yields ranged from 4.25 per cent to 7.60 per cent.

New German Issue

Saxon Public Works, Inc., Floats a Fifteen-Million-Dollar Offering in Twenty-Year Bonds

THE National City Company, which last week offered the investing public the ten-million-dollar issue of the German General Electric Company, again brought forward a German issue during the past week—the first mortgage sinking-fund gold bonds of the Aktiengesellschaft Sächsische Werke. The bonds were priced at 92 and accrued interest, to yield about 7.80 per cent. They were dated February 2, 1925, and are due February 1, 1945. The proceeds of the issue will be used to defray the major portion of the cost of erection of a new 100,000-kw. power plant at Böhlen, extensions to the transmission and distribution facilities and for other purposes.

The Saxon Public Works, Inc., is primarily engaged in the generation, transmission and distribution of electrical energy throughout the State of Saxony and in certain adjacent territories. The territory served embraces an area of about 6,950 square miles, with a total population of over 5,000,000, and includes Dresden, the capital of Saxony, and Leipzig. In January, 1924, independent experts valued the fixed assets and investments of the company at nearly $32,000,000.

Dividends Declared

Electric light and power companies and electric manufacturing companies announced the following dividends during the past week:

Name of Company	Per Cent	When Payable
Brooklyn Edison	2	Mar. 2
Consolidated Gas	$1.25	Mar. 16
Eastern Shore Gas & Electric	2	Mar. 2
Niagara Falls Power, com	50c.	Mar. 16
Niagara Falls Power, pf	43¾c.	Apr. 15
Pacific Gas & Electric, 1st pf	1½	Feb. 16
Pacific Lrghting, com	2½	Feb. 16
Pacific Lighting, pf	1¾	Feb. 16
Penn. Ohio Power & Light, 8% pf	2	Feb. 2
Penn-Ohio Power & Light, 7% pf	1¾	May 1
Tri-City Railway & Light, com	2½	Apr. 1
Tri-City Railway & Light, com	2½	July 1
Tri-City Railway & Light, com	2½	Oct. 1
Tri-City Railway & Light, com	2½	Jan. 1, 26
Utilities Power & Light, class A	50c.	Apr. 1
White (J. G.) Management Corp., pf	1¾	Mar. 2
Wisconsin Power & Light, pf	1¾	Mar. 16
Wisconsin River Power, pf	1¾	Feb. 20
Radio Corp. of America, pf	1¾	Apr. 1

Company Reports

Among the company reports issued during the past week for the month of December were the following:

Name of Company	Gross Revenues for December 1924	1923
Alabama Power	$816,889	$740,926
Blackstone Valley Gas & Electric	437,434	397,760
Columbus Electric & Power	216,569	189,567
Commonwealth Power	3,009,196	3,053,656
Consumers Power	1,647,217	1,625,550
Cumberland County Pwr. & Lt.	368,682	349,712
East Penn Electric	300,978	279,805
Eastern Texas Electric	202,032	189,400
Galveston-Houston Electric	330,667	297,076
General Gas & Electric	1,798,971	1,377,523
Great Western Power System	647,133	641,084
Metropolitan Edison	730,809	686,577
Mississippi River Power	246,811	239,345
New Jersey Power & Light	107,571	96,048
Northern Texas Electric	248,288	262,406
Pennsylvania Edison	261,885	270,219
Portland Electric Power	974,992	959,769
Puget Sound Power & Light	1,178,106	1,147,504
Tennessee Electric Power	934,548	823,546
Utah Securities	1,030,559	953,101

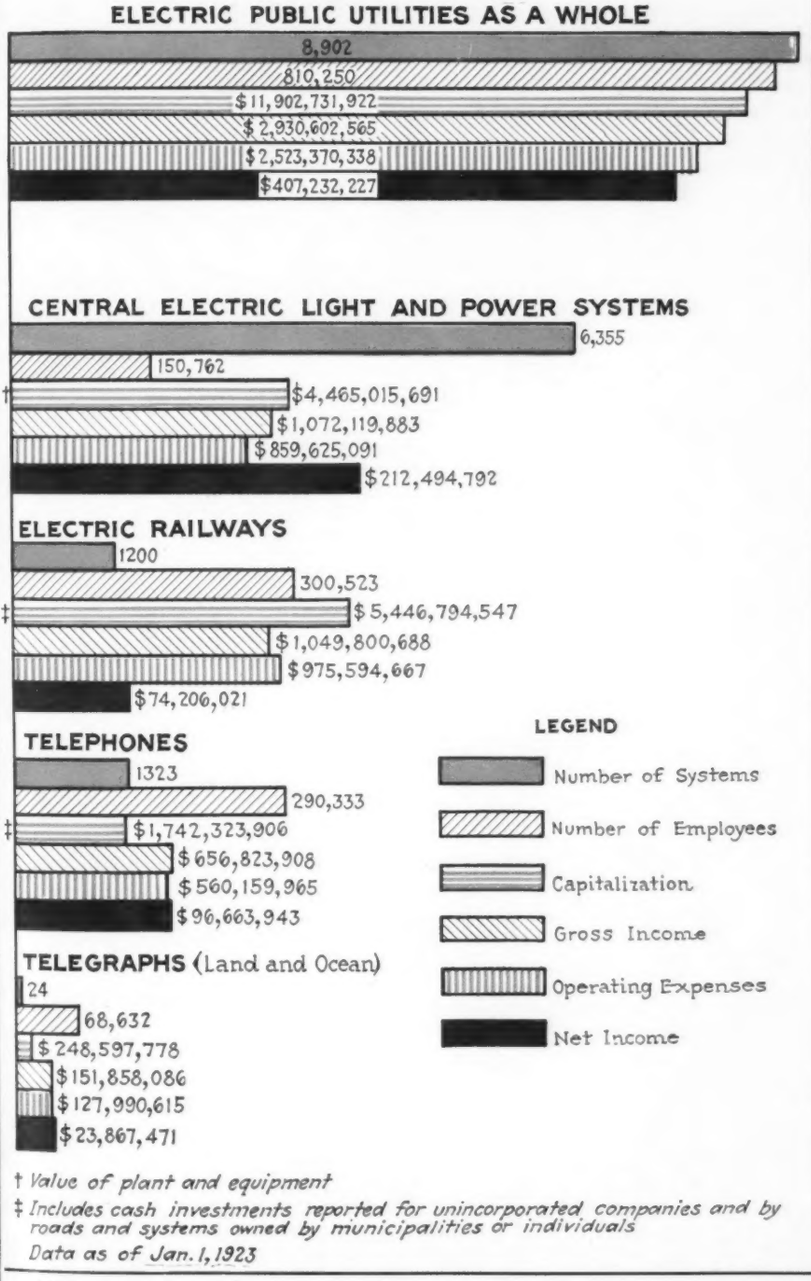
SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN JANUARY

Name of Company	Amount of Issue	Period, Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Central Illinois Pub. Serv. Co.	$4,800,000	½—3	Serial gold notes	To acquire securities of other utilities	4½ and 5	98.05 to 100.05	4.25 to 5.75
Associated Gas & Elec. Co. (N. Y.)	5,200,000	...	Class A, common stock	To reimburse for expenditures against new properties and for other corporate purposes	2	26	....
American Public Utilities Co. (Mich.)	1,000,000	...	Prior preferred cumulative stock	Extensions and for other corporate purposes	7	92	7.60
Memphis Power & Light Co. (Tenn.)	990,000	...	Cumulative preferred stock	Additions, improvements and general corporate purposes	7	99	7.07
Public Service Elec. & Gas Co., (N.J.)	15,000,000	...	Cumulative preferred stock 1925 series	To reimburse for expenditures and additions to property made and to be made	6	95	6.32
Edison Electric Illuminating Co. of Boston (Mass.)	30,000,000	3	Coupon gold notes	To retire floating indebtedness and for future extensions of the property	4½	99.31	4.75
Knoxville Pwr. & Light Co. (Tenn.)	500,000	...	Cumulative preferred stock	To reimburse for additions and for other corporate purposes	7	99	7.07
Consumers Power Co. (Mich.)	5,000,000	...	Cumulative preferred stock	To reimburse treasury for expenditures for additions, refunding and to provide funds for further improvements	6.6	100	6.6
Community Pwr. & Light Co. (Ill.)	1,000,000	...	Cumulative first preferred stock	To finance acquisition of group of properties and construction of transmission line extensions	7	94	7.45
	2,250,000	25	First mortage collateral sinking-fund gold bonds, series B		6	97	6.25
Iowa Southern Utilities Co. (Del.)	1,000,000	...	Cumulative preferred stock	To finance cost of additional properties	7	93½	7.49
Southwest Power Co.	1,000,000	19	First mortage sinking-fund gold bonds, series B	Acquisition of new properties	6	95½	6.40
Cities Service Co. (N.Y.)	2,500,000	41	Convertible gold debentures, series D		7	99¼	7+
El Paso Electric Co. (Tex.)	1,500,000	...	Cumulative preferred stock, series A	To retire floating debt and for other corporate purposes	7	103	6.80
Ohio Public Service Co.	3,000,000	...	Cumulative first preferred stock, series A		7	100	7
United Light & Power Co. (Md.)	3,010,000	...	Cumulative preferred stock, class A, first series	To acquire stocks of controlled companies	6½	86	7.55
Gladwin Light & Power Co. (Mich.)	125,000	19	First mortage sinking-fund gold bonds, series A	Retirement of outstanding bonds and for additions	6	96½	6.33
Laurentide Power Co., Ltd. (Que.)	1,525,000	21	General mortgage sinking-fund gold bonds, series A	Retiring outstanding bonds and for extensions	5	99	5.60
Pacific Lighting Corp. (Cal.)	4,000,000	15	Secured gold bonds	To acquire control of other utility	6	100	6
Total	$83,400,000						

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

The Investment in the Electric Public Utilities Is Second Only to That in the Steam Railroads of the Country



† *Value of plant and equipment*

‡ *Includes cash investments reported for unincorporated companies and by roads and systems owned by municipalities or individuals*

Data as of Jan. 1, 1923

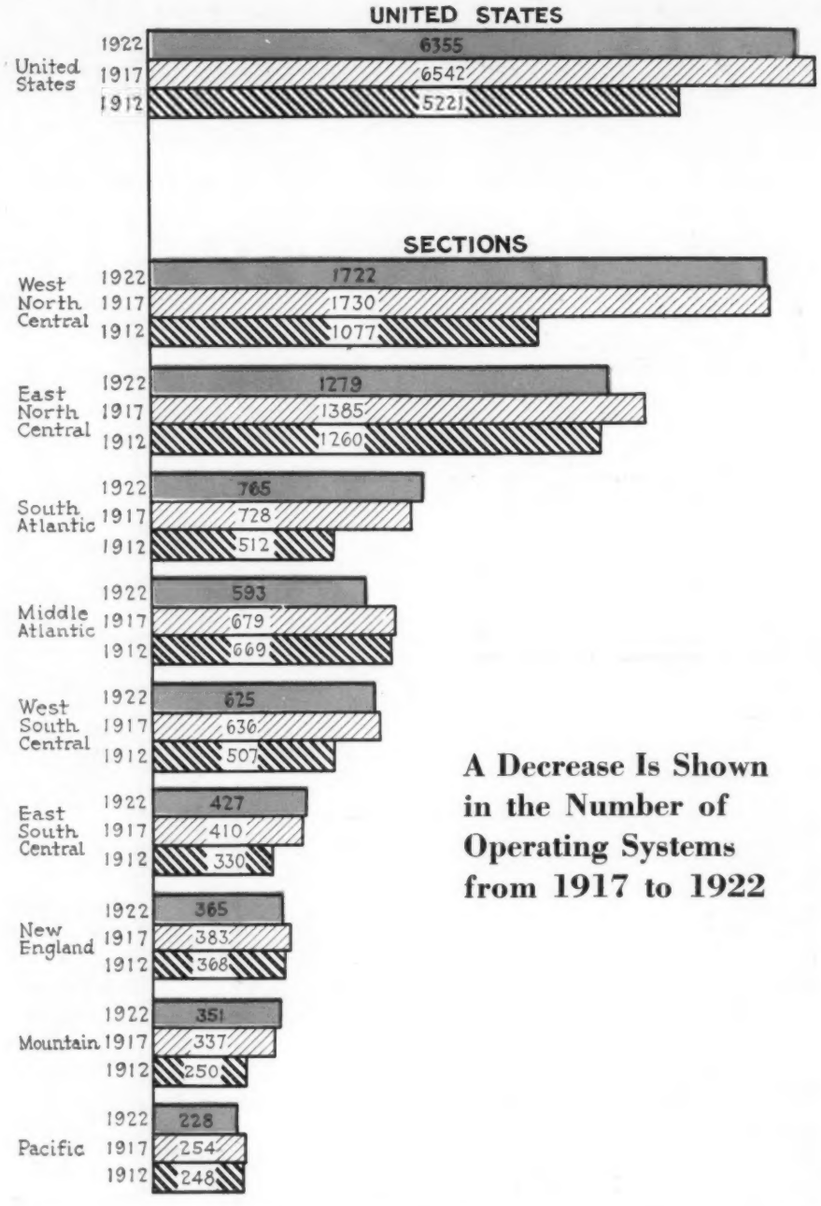
Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

The Place of the Electric Public Utilities

OUTSIDE of the industry itself few realize the place which the electric public utilities have assumed in the economic structure of the nation. One sees such a small part of this great industry that he fails to realize that the electric light and power companies, electric railways and the telephone and telegraph companies taken as a whole form the second largest financial combine in the United States. The steam railroads will continue to lead the electric public utilities for some years to come, but if the present rate of increase is maintained by these two groups of utilities the railroads must yield first place in a very few years.

The accompanying diagrams, which are based upon data issued by the United States Census Bureau, are as of January 1, 1923. Since that date it is estimated that approximately two and a half billion dollars have been invested in the electric public utilities of the country, bringing the total capitalization at the present time close to fifteen billion dollars. If the investment represented by the electrical manufacturing companies and electrical merchandising companies is added, then the total capital invested in the electrical industry as a whole will total over sixteen billion dollars.

Not only has the electrical industry grown to such large proportions financially but in public welfare and indispensability few other primary industries can claim as high a place. What chaos would befall the world should electrical energy suddenly cease to do its daily work for man can hardly be imagined. Such a condition would literally send the world back to the dark ages—admitting that civilization would be able to weather the shock at all.



A Decrease Is Shown in the Number of Operating Systems from 1917 to 1922

Centralization of Central-Station Control

IN very few cases do figures in themselves give a correct picture of progress. There are practically always some fundamental principles behind the figures which must be studied and understood before data on growth can be given their full weight. There are so many outside influences that progress is necessarily a composite picture not only of activities within but also from activities without.

The accompanying diagrams indicate that the number of central-station systems decreased by 187 during the interval from 1917 to 1922. This does not mean, however, that the industry has gone backward. On the contrary, it means that the central-station industry as a whole has materially advanced during this period. It means that despite the addition of many new systems the industry has become more cohesive and more efficiently operated by the merger of companies under one head. Capitalization of the industry has been one of the outstanding phases of the past five years development. This tendency has not been confined to any one section. The South Atlantic, East South Central and Mountain states are the only ones in which the number of systems increased during the period from 1917 to 1922, and the increase was in all cases comparatively small. The East North Central, Middle Atlantic and Pacific sections show the greatest tendency toward centralization of control.

The past year has witnessed perhaps an even extended tendency in this direction. More mergers were reported during 1924 than ever in the history of the industry, and 1925 will probably witness further activities in this direction.